Volume XIII
Number 1

FEBRUARY, 1922

$3.00 a Year
35c. Per Copy

The Journal of Educational Psychology

EDITORS

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PUBLISHED MONTHLY, EXCEPT JULY AND AUGUST, BY

WARWICK & YORK, INC.

LANCASTER, PA. BALTIMORE, MD.

[Entered as second-class matter at the postoffice at Lancaster, Pa., under the Act of March 3, 1879.]

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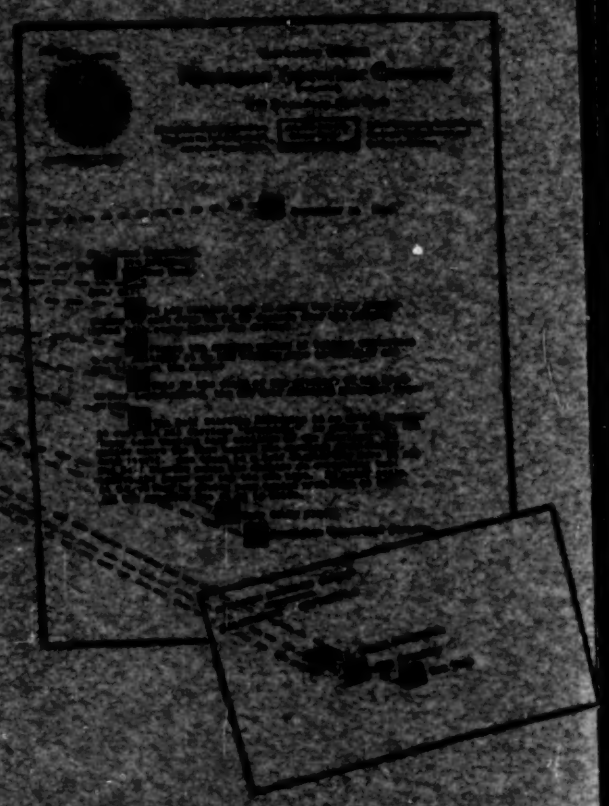

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VOLUME VIII JANUARY, 1917 NUMBER 1

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

A PRELIMINARY STUDY OF THE INHERITANCE OF ARITHMETICAL ABILITIES[1]

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I. STATEMENT OF THE PROBLEM

The aim of this paper is to set forth a method which seems to make possible a quantitative treatment of mental inheritance. The method has been tested in a study of the resemblance of child to parent in arithmetical constitution, that is, in the relations between the degrees of skill he shows in the simple arithmetical processes. The measurements made show that if, for instance, a child is much quicker than the average in subtraction, but not in addition, multiplication or division, it is to be expected that one at least of his parents shows a like trait; or, if he falls below the average in subtraction and multiplication, and exceeds it in addition and division, again the same will hold true of at

[1] This study was made under the supervision of Dr. Charles Zeleny, of the Department of Zoölogy, University of Illinois, whose criticism and suggestion were an indispensable aid. Acknowledgement is also due the cordial coöperation of the Department of Education of that university.

least one of his parents. The probability that this likeness is due to the organic continuity between parent and child is somewhat discussed. The report is based upon the results of a preliminary investigation begun in the fall of 1912 at the University of Illinois, where the coöperation of the Departments of Zoölogy and of Education gave unusual advantages for carrying on the work. It was found possible to test the theory by actual measurements of families, and to obtain a provisional measure of the degree of resemblance in families, which is significantly high; this may prove to be a hereditary likeness.

II. Method

The measurements were made by means of the Courtis Standard Tests in Arithmetic.[2]

In the work of measuring families, the tests were given almost as Mr. Courtis describes them and scored in terms of speed only as he recommends. The results of the first five only are here given.[3] Each was repeated before going on to the next, in order to lessen the effects of chance; and the average of the two trials was taken as the score. Directions to each group were made as brief, as simple and as nearly uniform as possible. To this end the same person gave them all, explaining merely that the object of the test was to learn each person's comparative speed in the different kinds of examples, and pointing out how this made it necessary to do each as fast as he could. I tried to have each group, and each member of a group, take the test in the same spirit, but differences in temperament made this well-

[2] These tests, the work of Mr. S. A. Courtis, Detroit, Michigan, were devised to measure the ease and accuracy with which pupils in the grammar grades could handle two-figure combinations in addition, subtraction, multiplication and division, and a variety of simple problems in arithmetic. The eight tests are described and illustrated in Mr. Courtis' recent report (Courtis 1913) to the Committee on School Inquiry of the New York Board of Estimate and Apportionment, on the Courtis Tests in Arithmetic which he had just carried out in that city. The first five, those from which these data are drawn, are as follows:

Test No.	1.	Speed Test	—Addition	}	Combinations 0–9
" "	2.	" "	—Subtraction		
" "	3.	" "	—Multiplication		
" "	4.	" "	—Division		
" "	5.	" "	—Copying Figures (Rate of motor activity)		

Mr. Courtis describes the tests from an educational point of view, but his account brings out their accuracy, and their fitness for the work of comparing abilities in the same individual, and individuals with one another.

The three longer and more complex tests were given at the same time; their results are less easy to interpret and will be left to a later paper.

nigh impossible. This, however, is a factor which presumably affects the tests as a whole and not relative excellence in any two tests. The resemblances found cannot be due to the fact that all the members of a family were tested at the same time, for it was found (1) that an unrelated person tested with a family does not show the resemblance, and (2) that a group of unrelated persons tested together does not show resemblance among its members. Such unrelated groups show the same random resemblance, or lack of it, as appears in the general population. (See Fig. III.)

Between each two tests there was an interval of two or three minutes, during which each subject was asked to count his answers and mark the score on the sheet itself and on the record sheet he had already filled out with his name, sex, age, and the date and time of the test. These counts were later verified; at this time they served three purposes: (1) they added interest to the tests; (2) they took up the time of relaxation between the tests; (3) they made a single rechecking sufficient.

Minor variable factors, such as time of day, physical and mental condition, distraction, discomfort, seem to have caused what differences were found when the same person was tested at different times. These were not enough to change materially the direction of the curve. Figure I shows the curves of a person tested four times, at nine-day intervals. Any constant factors whose presence was not detected and allowed for must have in all probability affected the scores in all five tests alike which would change the individual curve in position rather than in shape. The presence of constant sources of error may be one reason why children and parents are more alike in the relations they show between the various abilities than in absolute standing in any one ability.

What differences may be due to age are unknown, so no steps could be taken to eliminate them. It seems probable that there may be a slowing down of all processes after maturity is passed; in this case there need be no change in the shape of the curve. In face of the close likeness between parent and child this conclusion is almost forced upon us.

No sex differences have been noted. This accords with Mr. Courtis' observations on thousands of cases. Moreover, a child of either sex may resemble either parent; and all the children of the same family do not always resemble the same parent.

III. Subjects

Few families are both willing and able to give an hour or an hour and a half of their concerted time to the taking of these tests. A beginning was made by sending a circular letter to eighty members of the faculty of the University of Illinois, inquiring as to their willingness to take part in the tests. From the twelve families who replied favorably, and almost as many others learned of from these, records have been gathered. On eight of these families—all, in fact, in which the children were over fourteen years and therefore comparable, this preliminary report is based. To make possible the comparison of these records, however, it was necessary to know the average adult scores for the class of people under consideration. To this end several university classes, in education and zoölogy, were through the coöperation of Dr. Bagley and Dr. Zeleny submitted to the tests, as was a volunteer group of graduate students in science. It will be noticed that all the work has been done among a highly educated class of people. It seemed most feasible, and also advisable, that the problem should be thus limited at first, in order that the results of the preliminary work should have as definite a meaning as might be. All the averages, therefore, and exact numerical statements will be understood to apply merely to this class.

IV. The Records

The records from which conclusions are here drawn are the score sheets of two hundred unrelated adults, and of the eight families including twenty individuals (See Appendix I). Each score sheet gives the score in each of the two trials of each test, with the average of the two. In two families four trials on different days were made, in the hope of increasing the accuracy. These were in one case at four-day, in the other at nine-day intervals, that the effect of practise might be kept down (See Figure I). Seven individuals also who had taken the tests in the ordinary way were tested a second time after an interval of weeks, and one a third time; as the second and third curves were similar in form to the first, the chance errors in making the tests in this way may probably be neglected. Were the correlation perfect, every chance error in testing must reduce it; hence where the obtained correlation is high it may safely be said the correlation must be still higher.

V. Treatment of Records

Very early in the work, as has been said, the need for an adult average was felt. To meet this, as many adults as possible were tested during the year, and from the two hundred records obtained the averages used in calculation were computed (see Table I). From these and the standard deviation (φ) in each operation a graph sheet has been arranged which seems suitable

TABLE I.

Average and Standard Deviation for each Operation

	Average no. of examples per minute	φ = Standard Deviation
Addition	73 (74)*	15
Subtraction	60 (64)	14
Multiplication	53 (52)	11
Division	58 (55)	14
Copying Figures	124 (135)	17

* The numbers in parenthesis are the averages found by B. T. Baldwin at Swarthmore College, and are inserted here for comparison. (See *School and Society*, 1: 1915, 569–576.)

for use with individuals over fourteen years (see Figure II). The average for each operation forms the zero point of the scale, above or below which every individual falls; these zero points are placed one below another down the middle of the sheet. The standard deviation is taken as the unit distance above and below zero. Thus a person whose score in addition is above the average by two and one-tenth times the standard deviation stands at 2.1 on the line representing addition.

In the numerical handling of the records, also, individual standing has been expressed in terms of the standard-deviation unit; that is, as being so many times the standard deviation, above or below the average. For instance, suppose a score in addition is 82 examples done in one minute. This is nine more than the average. Since the standard deviation is 15, this score would become +0.67, or almost seven-tenths of a unit above the average. Or, a score represented as +1.70 would be interpreted thus: since 1.70 means above the average by 1.70 times the standard deviation, which is 14, this score is 25.5 above the average (73). This means an actual accomplishment of 98.5 examples in one minute.

This method of expression was chosen in order to bring all the operations to the same terms, that different operations might

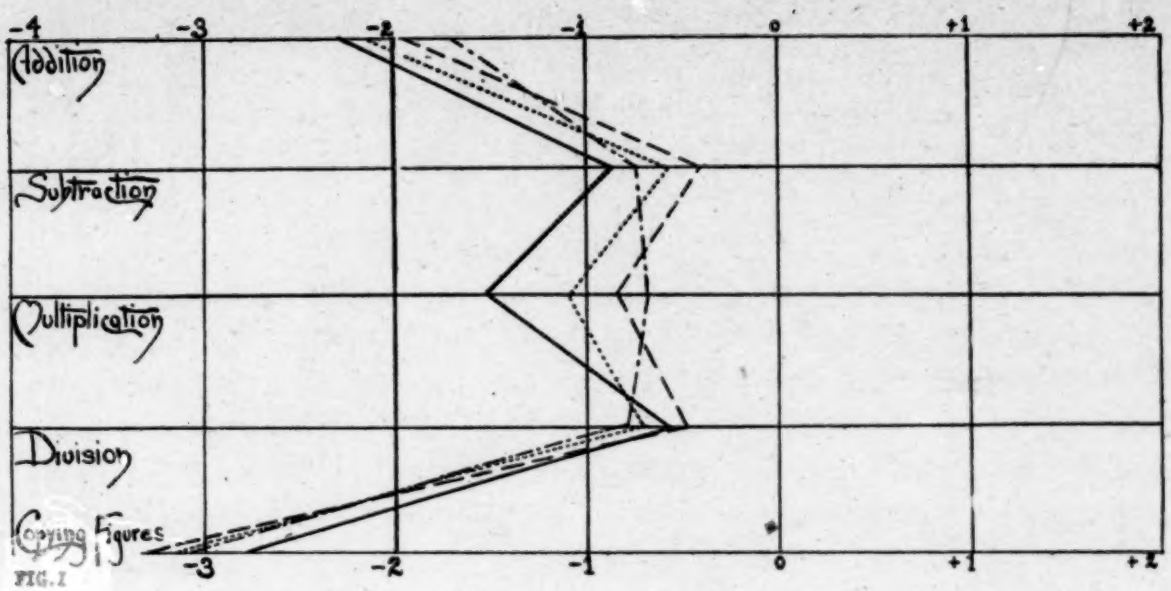

FIG. I

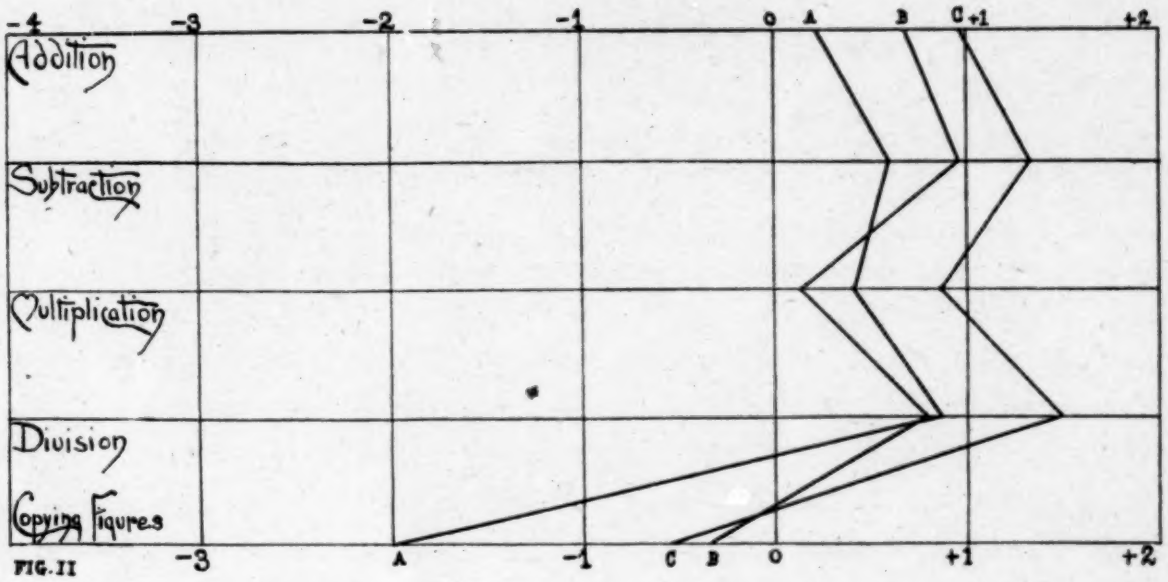

FIG. II

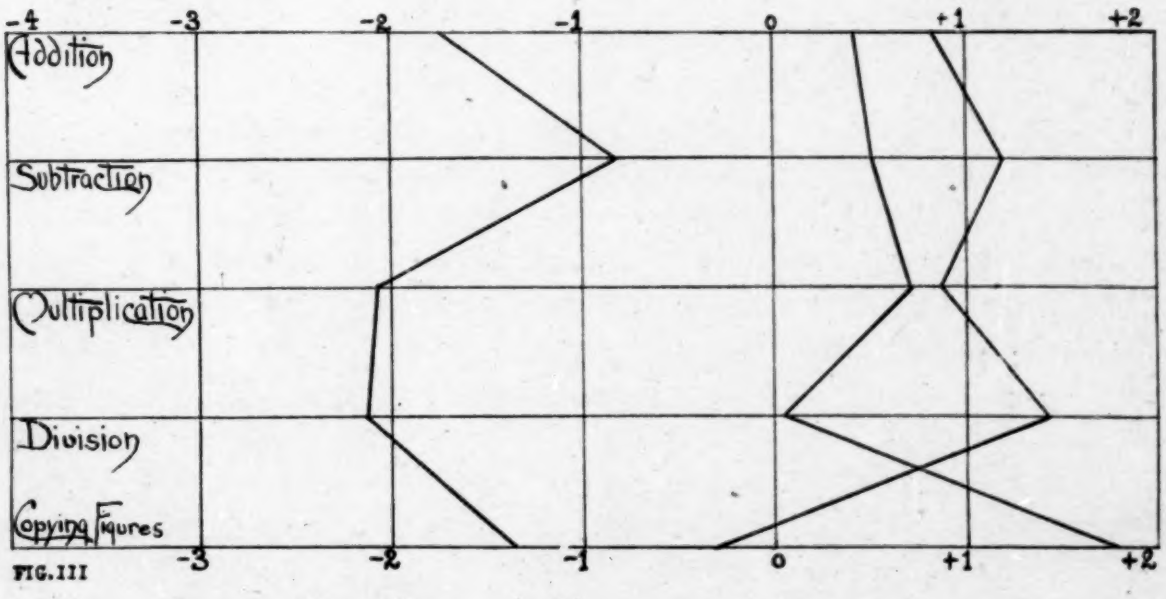

FIG. III

Figure I. Curves of One Person Tested at Four Times.
1st test .....
2nd test —.—.—.—
3rd test ————————
4th test — — — —

Figure II. Curves of Parent (A) and Two Children (B & C.)

Figure III. Three Unrelated Curves.

be directly compared. If, for instance, my score in addition when transmuted to standard deviation units is +0.55, and in subtraction +0.86, the relation between them may then be expressed as +0.31; that is, to move from the addition standing to the subtraction standing is to move in the positive direction through .31 of the standard deviation unit, which is made the same size in each case. A glance at Figure II, curve B, will make this clear. Further, if the multiplication score is +0.03, the division +0.63, and copying figures —0.50, the subtraction—multiplication relation is —0.83, the multiplication—division relation +0.60, and that between division and copying figures —1.13. (See Table II and Figure II, Curve B.) It is relations such as these which have been compared in parent and child.

My mother's scores, for example, though differing in *absolute* value from mine, still bear to one another the *relations* shown in Table II (first two columns) and Figure II, Curves A and B;

TABLE II.

Relations Between Operations in Mother and Daughters

Relations	Mother	1st Daughter	2nd Daughter
Add.—Sub.....	+0.35	+0.31	+0.36
Sub.—Mul.....	—0.10	—0.83	—0.44
Mul.—Div.....	+0.36	+0.60	+0.57
Div.—c. f.....	—2.91	—1.13	—2.08

hence there is evidently some degree of correspondence, while with the figures given for a younger daughter the correspondence is even closer (see Table II, first and third columns, and Figure II, Curves A and C). Figure III shows the curves of three unrelated persons. In calculating the coefficients of correlation, not only these successive relations, but also the relations between addition and multiplication, addition and division, subtraction and division, and between each of these and copying figures, have been used. The degree of correspondence has been worked out by the Pearson product-moments method.

VI. Results

Before giving the results of the work, I wish to bring up once again the point, that the correlation between the *actual scores* of child and parent in a *given operation* is not the subject of this paper. That such a correlation exists, the curves bear witness; and some attention has been given to it. A child whose parents make high scores is more likely than not to make high scores himself. The correlations for this relation are given in Table III. (See also Figures IV and V.)

TABLE III.

Coefficient of Correlation Between Absolute Scores of Child and Parent

	Child and Mid-parental standing	Child and Like Parent	Child and Unlike Parent
Addition	+0.28	+0.54	+0.05
Subtraction	+0.01	+0.27	—0.11
Multiplication	+0.55	+0.79	+0.24
Division	+0.31	+0.44	+0.08
Copying Figures	+0.45	+0.65	+0.13
Average	+0.32	+0.54	+0.08

But attention has been given primarily to the fact that a child whose parents make better scores in subtraction than in addition is likely himself to make better scores in subtraction than in addition; here the coefficient of correlation with that one of the parents whom the child more resembles is +0.71 (see Tables IV and V). In terms of the graph, it is likeness in form, not in position, between the curves of parent and child with which we are chiefly concerned (see Figure II).

An instructive way to get the significance of the correlations which show themselves between parent and offspring from this treatment of the data is to ask ourselves what the figures would be, under stated conditions; and to use these as a basis of comparison. Three hypotheses are possible: (1) there is no resemblance between these traits in child and in parent; (2) there is resemblance due to the action of heredity; (3) there is resemblance due to the action of environment.

(1) If a child showed no tendency to do better in the operations in which his parent did better, than in other operations, the following statements should hold true:

TABLE IV.

Coefficients of Correlation, Actual and Hypothetical

	Child's Coefficient of Correlation			
		With resemblance due to		
With	With no resemblance	Inheritance and perfect Blending	Inheritance and Segregation	Actual Figures
Midparental standing	0.00	Approaching +1.00	Over +0.50	+0.49
More like parent	+0.25*	Towards +0.75	Approaching +1.00	+0.60
More unlike parent	—0.25*	Toward +0.25	0.00	+0.13

TABLE V.

Coefficients of Correlation

(Method 1)

Child with	Simple operations	Copying figures	Average
Midparental standing.....	+0.34	+0.64	+0.49
Like Parent.....	+0.48	+0.72	+0.60
Unlike Parent.....	+0.04	+0.21	+0.13

TABLE VI.

Coefficients of Correlation

(Method 2)

Child with	Simple operations	Copying figures	Average
Midparental standing.....	+0.34	+0.67	+0.51
Like Parent.....	+0.46	+0.73	+0.60
Unlike Parent.....	—0.10	+0.15	+0.02

* These figures have been worked out empirically. (See Table IX.)

(a) Between child and an arbitrary midparental standard half-way between the standings of the two parents, there should be no correlation, that is, the coefficient should be zero.

(b) Between child and more like parent there should in the long run be a positive correlation of about +.25 because the comparison is made each time after choosing the more like of two parents.

(c) Between child and the more unlike parent there should in the long run be a negative correlation of about —.25 because the comparison is made each time after choosing the more unlike of two parents.

A glance at Table IV, which compares the figures actually found with this hypothesis and those that follow, shows that this at least is far from fitting the facts. The figures indicate, on the contrary, a strong resemblance to one parent, and a distinct resemblance to the midparental standing.

(2) If the resemblance is due to heredity alone, there are two extreme cases for which we can foretell the correlations rather exactly. (a) If, on the one hand, the qualities in the child are the result of a perfect blending of those of the parents, the conditions should be these:

i. Between child and midparental standard there should be perfect correlation, diminished only by the tendency to regress towards the mean. The coefficient should be almost +1.00.

ii and iii. Between child and each parent there should be a positive correlation, very much less than one, and very little greater when the like than when the unlike parent is chosen. Again, this does not fit the actual figures (see Table IV).

(b) If, on the other hand, the relations between operations are inherited by each child from one parent only (that is, if there is segregation of these qualities), the following should be the conditions:

i. Between child and midparental standing there should be a positive correlation greater than +0.50.

ii. Between child and like parent there should be perfect correlation; that is, the coefficient should be +1.00.

iii. Between child and unlike parent there should (unless the parents are correlated) be no correlation; that is, the coefficient should be zero.

Table IV shows that the figures found come closer to this last condition (hereditary with segregation) than might be expected in working on the inheritance of human traits, where heredity correlations are bound to be obscured. So this hypothesis may be at least provisionally retained; and, since the figures fit this and not the previous hypothesis, it must be said that if the resemblance is due to inheritance, there is in the germ cells partial if not complete segregation of the factors involved.

(3) If the resemblance is due to environment alone, we can make no forecast as to the relative values of these three correlations. We must look at the question from the other side; given these resemblances, can we find factors in the environment which may have produced them? Are there relations between the child and his environment which can have acted in such a way as to bring about a strong likeness in these traits to one parent, and practically none to the other? If a child is associated more closely with, or is directly taught by, one parent, will he grow to resemble that one in the relative ease with which he adds and subtracts? If so, children under the same teacher should become alike. They do not, for Mr. Courtis has shown that there is a wide range of variability not only of absolute but of relative facility in the different operations among children who have been under the same teachers and in the same classes,—far wider than the range among averages of children of the same grade, in different schools. That is, their curves vary not only in

position but in form. If the curves of the children owe their shape to association with the teacher, the reverse should be the case. But if the training received from the teacher does not bring this about, it does not seem that association with one parent could effect it, especially when the figures show that the other parent, with whom in many cases he has been almost as closely associated, has had no influence. This is a question on which further tests may throw more light, but if, in view of the approximation of the figures to what we might expect if segreating inheritance were the basis of the likeness, we provisionally accept this explanation, then it must be considered whether training does not introduce a large factor of error in studying the laws of that inheritance.

The coefficients of correlation between child and parent, for the relation of speed in copying figures to speed in the simple processes, are higher than those for the relations between the simple operations themselves. This feature is constant throughout the results. Two possible explanations of this have suggested themselves. The higher correlation may be dependent on the fact that speed in copying figures has a psychological basis somewhat different from the others; it involves fewer factors and requires no "mathematics" whatever. A somewhat more likely hypothesis follows from the fact that in five of the eight families, including seventeen of the twenty children, the scores of the like parents happened to be extremely low in copying figures. Where the parent's variation from the average is so extreme, it may be that the trait is more strongly inherited; and it certainly seems evident that environmental or accidental differences in the curves, which in cases nearer the average might be so proportionally large as to hide the resemblance, would here have to be enormous to do so. Further tests will determine whether this is the correct explanation; if so, it furnishes further evidence that accidental and environmental differences have played a part in lowering the other correlations.

VII. Sources of Error

The sources of error, though many, cannot be held to be responsible for the correlations found. It was clear from the curves as they were first plotted that positive correlations such as we have reported must appear. Nevertheless, the sources of error

should be carefully considered; they show that stress must be laid not on the exact figures, but on the general trend of the results. In general, where there is a high correlation, the effect of chance is to lower the coefficient.

The sources of error may be considered in four groups. 1. Errors due to method of gathering data, which have been eliminated as far as possible, and have been discussed under method. 2. Errors due to the variability of the subjects, some of which could not be eliminated. These also have been discussed under method. 3. Mathematical errors. 4. Difficulties in interpretation of the results. These last two sources of error are important enough to deserve special discussion.

The mathematical means which were taken to make the scores comparable, and the method by which a coefficient of correlation was found, are well-established. Coefficients of zero between unrelated individuals, where the expected coefficient is zero, were secured by using the same methods. The data bearing on inheritance are, however, few. When the related pairs (parent and child) are grouped according to the particular trait considered, there are twenty such pairs in each group; as ten traits are considered, the figures for the average of the ten are based on 200 pairs. (Tables IV and VII.) When the related pairs are placed in groups each consisting of ten traits in one child and its parent, there are ten in each group, but twenty groups (Tables V and VIII). The figures for the average of the groups, based on the same 200 pairs, differ from the others by a small per cent. only. Tables VII and VIII give the figures thus obtained. (See also Figures IV and V.)

As to difficulties in interpretation of the results, our fourth source of error, there are many things to consider. In the first place, in comparing each child with his "like parent" a certain amount of correlation is introduced merely by picking out for comparison the parent that is more like the child. If series of groups, each of three persons, were made up at random from an unrelated population, and if then the third member of each group were compared with the more like of the other two in the same group, a certain correlation, due merely to the choice, would show itself. Since this is just the treatment that has been applied to the family groups, it becomes important to know how great is this introduced correlation, and what part of the corre-

TABLE VII.*

Details of Table V. Correlation Figures

Obtained by First Method

Relations	Correlation of child with midparental standard	Probable Error	Correlation of child with like parent	Probable Error	Correlation of child with unlike parent	Probable Error
Add.–Sub.	+.52	.17	+.71	.12	—.12	.23
Sub.–Mul.	+.55	.16	+.66	.13	+0.25	.22
Mul.–Div.	+.42	.20	+.52	.17	+0.22	.23
Add.–Mul.	+.57	.16	+.68	.13	+0.32	.21
Add.–Div.	.00	.24	+.09	.23	—.10	.23
Sub.–Div.	—.04	.24	+.21	.23	—.31	.21
Average	+.34		+.48		+.04	
Add.–c. f.	+.68	.13	+.75	.09	+.35	.21
Sub.–c. f.	+.72	.10	+.78	.09	+.21	.23
Mul.–c. f.	+.52	.17	+.60	.15	+.06	.23
Div.–c. f.	+.63	.14	+.77	.09	+.20	.23
Average	+.64		+.60		+.21	
Combined Average	+.49		+.72		+.13	

* The correlations are from twenty parent-child relations, in eight families. These probable error figures are for n = 8. If n = 20, the probable error is little more than *half as great.*

lation between child and each parent is to be laid to this treatment. Accordingly, three series of twenty each of just such random groups of three were made up, the third member of each group was treated as "pseudo-child," and correlations both with the more and the less like "pseudo-parents" were obtained. These data are displayed in Table IX. In brief, the correlation introduced by such a choice is +0.25 and —0.25, respectively. It is evident on comparing these figures with the correlations found with the like parent (+0.60) and with the midparental standing (+0.49), that both these figures are enough higher than +0.25 to indicate a distinct resemblance beyond what is due to the choice.

The correlation with the unlike parent is a different matter. If the qualities blend in inheritance, but not perfectly, it is difficult to know what to expect in regard to the less like parent.

TABLE VIII.

Details of Table VI. Correlation Figures

Obtained by Second Method

Case	Correlation of child with midparental standard in			Correlation of child with like parent in			Correlation of child with unlike parent in		
	Relations between simple operations	Relations of simple operations to copying figures	Averages	Relations between simple operations	Relations of simple operations to copying figures	Averages	Relations between simple operations	Relations of simple operations to copying figures	Averages
1	+0.05	+0.95	+0.50	+0.33	+0.96	+0.65	—0.40	+0.91	+0.26
2	—0.99	+0.97	—0.01	—0.80	+0.95	+0.08	—1.00	+0.97	—0.02
3	—0.35	+0.84	+0.25	—0.14	+0.84	+0.35	—0.51	+0.84	+0.17
4	+0.66	+0.99	+0.83	+0.85	+1.00	+0.93	+0.27	+0.97	+0.62
5	+0.26	+0.93	+0.60	+0.54	+0.94	+0.74	—0.18	+0.89	+0.36
6	+0.99	+0.78	+0.89	+0.99	+0.85	+0.92	+0.86	+0.42	+0.64
7	+0.23	+0.85	+0.54	+0.17	+0.94	+0.56	+0.25	—0.08	+0.09
8	+0.32	+0.86	+0.59	+0.33	+0.94	+0.64	+0.29	—0.10	+0.20
9	+0.86	+0.92	+0.89	+0.95	+0.77	+0.86	+0.82	+0.39	+0.61
10	+0.99	+0.87	+0.93	+0.98	+0.70	+0.84	+0.87	+0.59	+0.73
11	+0.29	+0.61	+0.54	—0.06	+0.77	+0.36	+0.24	+0.33	+0.29
12	+0.74	—0.15	+0.30	+0.80	+0.24	+0.52	—0.86	—0.86	—0.86
13	+0.65	+0.85	+0.75	+0.57	+0.68	+0.63	—0.44	+0.63	+0.10
14	+0.31	+0.75	+0.53	+0.91	+0.79	+0.85	—0.32	—0.78	—0.55
15	—0.43	+0.89	+0.23	+0.39	+0.88	+0.25	—0.40	+0.92	+0.26
16	+0.94	—0.32	+0.31	+0.92	—0.19	+0.37	+0.24	—0.41	—0.09
17	+0.78	+0.94	+0.86	+0.75	+0.95	+0.85	—0.55	+0.20	—0.18
18	—0.31	—0.99	—0.65	+0.57	—0.35	+0.11	—0.54	—0.99	—0.77
19	+0.81	+0.98	+0.90	+0.89	+0.97	+0.94	—0.23	—0.97	—0.60
20	+0.09	+0.94	+0.52	+0.11	+0.99	+0.54	—0.37	—0.96	—0.67
	+8.97	+14.92	+10.87	+10.66	+15.16	20)11.99	+3.84	+8.06	+4.33
	—2.08	— 1.46	— 0.66	— 1.39	— .54	+0.599	—5.80	—5.15	—3.74
	+20)6.89	+20)+13.46	20)10.21	20)9.27	20)14.62		20)—1.96	20)—2.91	20)0.59
	+0.34	+ 0.67	+ 0.51	+0.46	+0.73		—.098	+0.1455	+0.029
	+0.57		+ 0.508	+0.73			+0.145	+0.15	+0.02
	1.017			1.19			+0.047		
	+0.508			+0.595		+0.595	+0.02		

TABLE IX.

Correlation in Pseudo-families. Due to choice of Like and Unlike Pseudo-parents

	Series 3		Series 2		Series 1	
	Like	Unlike	Like	Unlike	Like	Unlike
A.–S.....	+0.07	—0.15	+0.08	+0.03	—0.07	+0.06
A.–M.....	+0.23	—0.01	+0.37	—0.46	+0.58	—0.12
A.–D.....	+0.25	—0.34	+0.38	—0.17	+0.48	+0.08
S.–M.....	+0.07	+0.06	+0.19	—0.17	+0.49	+0.05
S.–D.....	+0.24	—0.38	+0.17	—0.28	+0.15	+0.09
M.–D.....	+0.23	—0.35	+0.28	—0.27	+0.39	—0.05
	+0.18	—0.19	+0.25	—0.22	+0.34	0.00
A.–C.–F....	+0.24	—0.41	+0.06	—0.30	+0.42	—0.25
S.–C.–F....	+0.15	—0.27	+0.19	—0.19	+0.46	—0.38
M.–CF.....	+0.19	—0.28	+0.20	—0.31	—0.31	—0.43
D.–C. F....	+0.14	—0.46	+0.34	—0.19	+0.31	—0.35
	+0.18	—0.36	+0.20	—0.25	+0.29	—0.35

Average of three series for first six combinations (simple operations): Like +0.26; Unlike —0.14.

Average of three series for last four combinations (simple operations with copying figures): Like +0.22; Unlike —0.32.

	Like	Unlike
Combined Average	+0.24	—0.23

If the resemblance found is due to segregating inheritance, so that one parent has nothing to do with these qualities in the child, the expected correlation is 0. The results as shown are as close to 0 as could be expected with so few cases. Indeed, the facts on the whole are very nearly such as would be predicted from segregating inheritance.

But the possible effects of environment in producing this resemblance must also be taken into consideration. The resemblance is undoubted; but we are not safe in ascribing it to heredity at all until we know whether there is any environmental influence which may cause each child to resemble father or mother, but not both. This can probably be tested, but no tests have yet been made. It is nevertheless so difficult to conceive of any factor in the environment which could bring this about, that we may provisionally consider heredity as the most probable cause of the resemblance. Environment and especially the effect of training doubtless modify the original resemblance sufficiently to be considerable sources of error in attempted measurements of heredity.

Summary

1. The resemblance in arithmetical constitution between twenty non-selected children above fourteen years of age and their parents has been measured by the application of the Courtis Tests in Arithmetic, Series A.

2. The scores of these families were compared with norms determined for the purpose by testing two hundred individuals of the same maturity and social and academic status.

3. The resemblance studied was not that between absolute efficiency of parents and their children in addition, subtraction, multiplication, division and copying figures, but that between the relations between these efficiences obtaining in the child, and the same relations obtaining in his parents. The results show that the relations of a child's skills in the four simple processes to each other and to his speed in copying figures tend to resemble the corresponding relations in one or the other of his parents. His skill in any one process tends to be greater or less than his skill in any other process, according as the parent's skill in that process is greater or less than in that other.

4. A child of either sex may bear this resemblance to either parent, but to one only. The Pearson coefficient of correlation for these twenty children is +0.60 when they are compared with the like, and +0.01 when they are compared with the unlike parent.

5. A child shows a greater resemblance to the like parent than to the mid-parent: the Pearson coefficients are +0.60 and +0.49, respectively.

6. It is difficult to avoid the conclusion that this likeness is due to heredity.

APPENDIX I.

Actual Scores (First and Second Trials) of Twenty Children and Parents in Eight Families.

Families 3 and 8 were tested four times, at intervals of four days and nine days respectively

1. Family	Age	Addition	Subtraction	Multiplication	Division	Copying Figures
1. Father	52	69 76	60 62	52 60	59 66	108 122
Mother	57	75 77	65 68	51 64	65 74	81 99
Daughter	27	81 85	70 77	52 57	69 69	115 121
Son	26	87 87	64 76	56 67	61 70	112 126
Daughter	22	68 72	60 64	54 59	50 51	110 117
Daughter	20	85 90	72 85	55 70	74 84	106 123
Daughter	19					
2. Father	51	70 75	61 65	48 50	57 59	85 94
Mother	51	66 63	51 49	23 23	39 46	105 108
Son	23	100 97	77 88	51 64	75 81	143 140
Son	21	66 75	55 60	41 54	31 53	93 103
Daughter	19	63 76	56 57	45 54	53 68	113 113
Son	17	62 71	51 54	38 40	48 53	105 112
Son	16	54 68	55 59	31 40	48 59	98 106
3. Father	62	47,56,51,49	49,48,49,52	32,33,32,36	33,33,32,33	93,100,105,110
Mother	55	34,38,35,38	20,25,27,24	24,30,29,24	20,25,28,27	80, 85, 90, 91
Daughter	28	65,68,62,67	54,62,57,53	43,50,51,53	52,55,53,60	112,120,128,125
Daughter	25	77,73,70,78	53,64,65,63	42,45,45,55	40,50,54,57	110,116,116,119
Daughter	22	39,42,36,35	37,44,45,45	27,28,42,44	24,30,32,35	94,103,105,104
4. Father	—	75 80	60 67	49 56	60 62	94 108
Mother	42	65 68	57 62	49 50	52 56	126 140
Daughter	18	76 76	55 61	40 56	58 62	115 121
5. Father	44	61 64	50 44	47 44	35 34	129 138
Mother	—	82 82	69 60	57 68	59 55	150 159
Son	15	56 55	27 32	42 50	49 51	135 143
6. Father	42	84 90	66 67	50 60	60 65	122 130
Mother	—	83 88	57 67	58 67	72 80	119 133
Daughter	15	71 80	50 53	43 58	59 67	119 137
7. Father	61	41 46	35 40	27 29	26 33	55 56
Mother	52	67 66	47 52	47 51	50 57	112 118
Daughter	25	103 113	108 115	60 85	99 115	130 145
Son	18	60 52	39 41	40 43	36 43	125 130
8. Father	44	80,77,80,86	60,69,69,70	53,56,60,58	62,62,65,70	126,135,136,145
Mother	50	57,47,50,52	49,47,44,52	38,39,40,48	38,44,46,49	82, 88, 95, 95
Son	17	45,50,41,48	55,54,50,55	42,47,38,44	51,50,52,53	77, 77, 80, 75
Son	14	63,63,64,62	46,51,57,56	45,48,48,52	37,44,46,50	78, 89, 98, 96

Explanation of Figures IV and V

The curves in figures IV and V are samples of a large number of curves constructed to express correlations between parent and child. They were constructed by arranging the twenty parents according to rank in the character considered, and placing them at equal intervals along the ordinate or Y-axis (vertical dash line); and arranging the children similarly along the abscissa, or X-axis (horizontal dash line). Then the distance of the parent's rank from the abscissa, and of the child's from the ordinate, determine the position of the point on the curve. It is evident that if the first child were the child of the first parent, the second child, the child of the second parent, and so on, the curve would be a straight line at an angle of 45° to abscissa and ordinate. Departure from this line means departure from complete correspondence between the rank of parent and that of his child. This oblique line, which represents complete correspondence in rank, has been drawn in over the curves. But it has been run not from corner to corner of the figure but through the zero point, where X-axis and Y-axis cross. It should be understood that the position of the X-axis and of the Y-axis represents the average position obtained from the scores of 200 unrelated individuals already mentioned. The fact that the intersection of these axes does not lie in the center of the squares is due to the fact that the parents and children in the twenty families here charted are not equally distributed above and below this average. This combination of rank and absolute standing is perhaps unjustifiable, for it is the line from corner to corner which represents perfect correlation as far as rank is concerned. But if this is kept in mind, the method is not misleading; and though it is of course a rough and ready method, it has seemed to be clear and convenient.

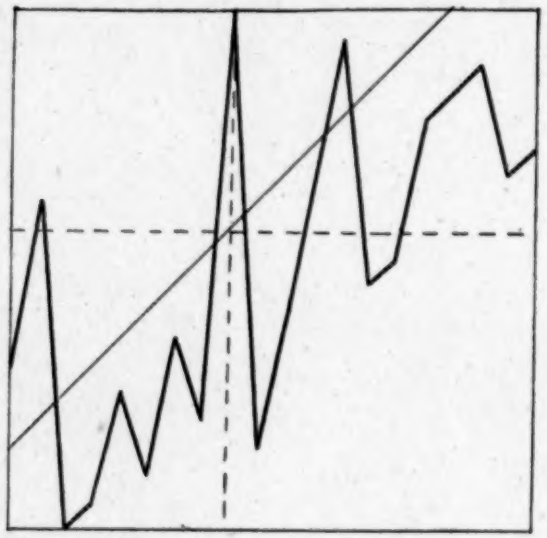

FIG.IV (A)

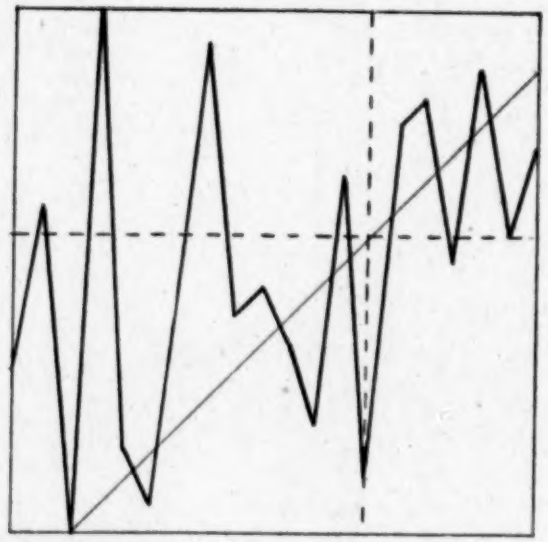

FIG.IV (B)

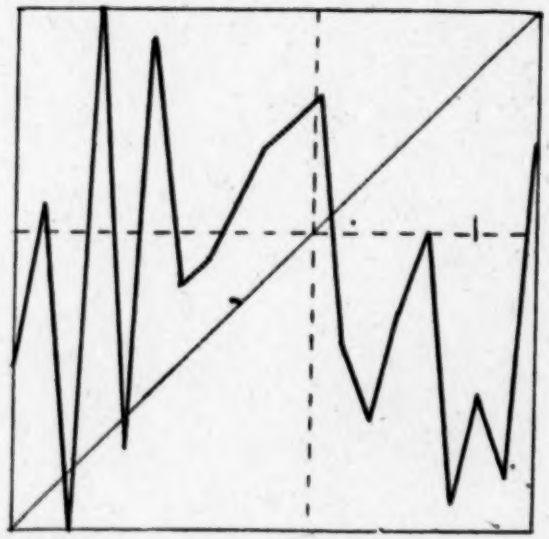

FIG.IV (C)

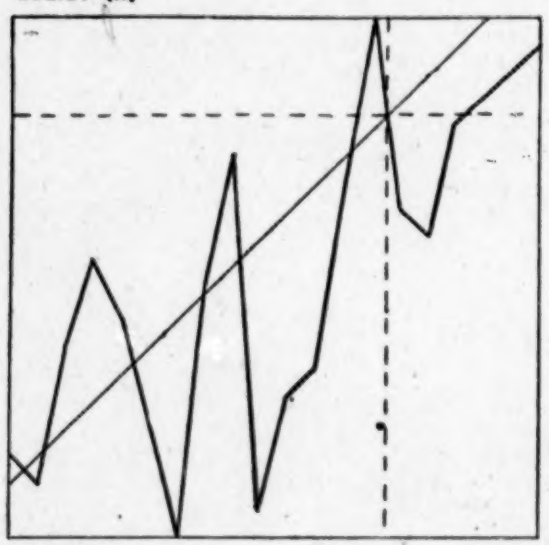

FIG.V (A)

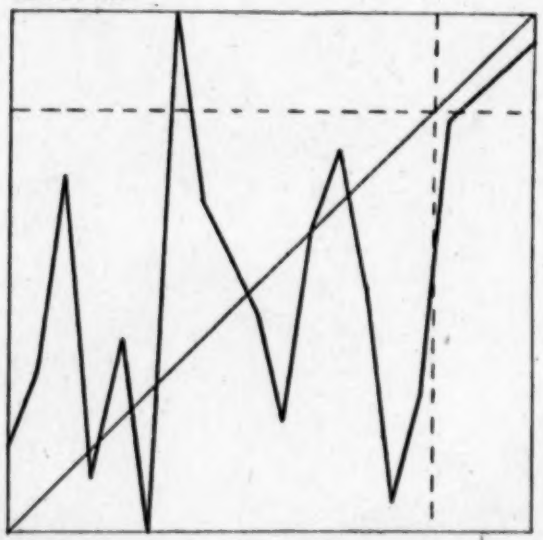

FIG.V (B)

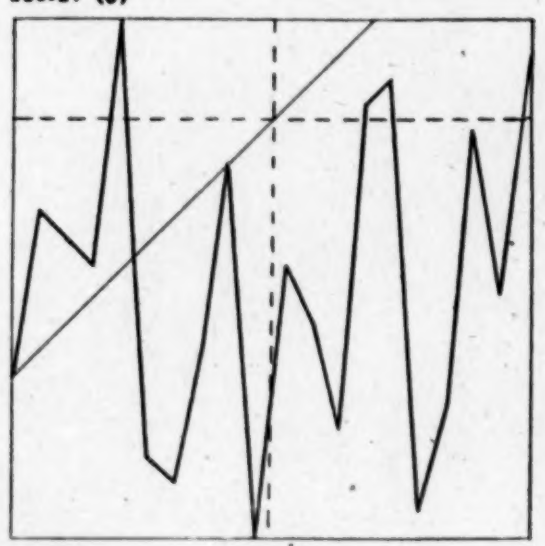

FIG.V (C)

Fig. IV. Curves representing correlation in rank among twenty parent-child pairs, in *addition*.
A—like parent. B—midparental standing. C—unlike parent.
Fig. V. Curves representing correlation in rank among twenty parent-child pairs, in the *division—copying figures relation*.
A—like parent. B—Mid-parental standing. C—unlike parent.

APPENDIX II.

Deviations from the Mean Expressed as Multiples of the Standard Deviation, for Sixteen Parents and Twenty Children (Eight Families)

Used in Calculating Coefficients of Correlation

1. Family	Addition	Subtraction	Multiplication	Division	Copying figures
1. Father	—0.03	+0.07	+0.27	+0.32	—0.53
Mother	+0.20	+0.54	+0.41	+0.82	—2.00
Daughter	+0.67	+0.96	+0.14	+0.79	—0.35
Son	+0.93	+0.71	+0.77	+0.54	—0.29
Daughter	—0.20	+0.14	+0.32	—0.54	—0.62
Daughter	+0.97	+1.32	+0.86	+1.50	—0.56
Daughter	0.00	+0.18	—0.32	+0.21	—0.56
2. Father	—0.03	+0.21	—0.36	0.00	—2.03
Mother	—0.47	—0.64	—2.73	—1.11	—1.03
Son	+1.80	+1.61	+0.41	+1.43	+1.12
Son	—0.17	—0.18	—0.50	—1.14	—1.53
Daughter	—0.23	—0.25	—0.32	+0.18	—0.65
Son	—0.43	—0.54	—1.27	—0.54	—0.91
Son	—0.80	—0.21	—1.59	—0.32	—1.30
3. Father	—1.47	—0.75	—1.82	—1.79	—1.30
Mother	—2.47	—2.57	—2.36	—2.36	—2.21
Daughter	—0.50	—0.25	—0.36	—0.21	—0.18
Daughter	+0.10	+0.07	—0.55	—0.57	—0.53
Daughter	—2.33	—1.21	—1.64	—2.00	—1.32
4. Father	+0.30	+0.25	—0.05	+0.21	—1.35
Mother	—0.43	—0.04	—0.32	—0.29	—0.53
Daughter	+0.20	—0.14	—0.45	+0.14	—0.35
5. Father	—0.70	—0.71	—0.55	—1.64	+0.56
Mother	+0.60	+0.64	+0.77	+0.07	+1.79
Son	—1.13	—2.18	—0.64	—0.57	+0.88
6. Father	+0.93	+0.46	+0.18	+0.32	+0.12
Mother	+0.83	+0.14	+0.86	+1.29	+0.12
Daughter	+0.17	—0.61	—0.23	+0.36	+0.24
7. Father	—1.97	—1.61	—2.27	—2.04	—4.03
Mother	—0.40	—0.75	—0.36	—0.32	—0.53
Daughter	+2.33	+3.68	+1.77	+3.50	+0.79
Son	—0.87	—1.43	—1.05	—1.32	+0.21
8. Father	+0.53	+0.50	+0.36	+0.50	+0.68
Mother	—1.43	—0.68	—1.09	—1.00	—2.00
Son	—1.80	—0.46	—0.91	—0.46	—2.76
Son	—0.67	—0.54	—0.55	—1.00	—2.00

THE AUDITORY MEMORY AND TACTUAL SENSIBILITY OF THE BLIND

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Harvard University

Certain differences between the blind and seeing persons—notably in the excellence of memory for things heard and in tactual sensibility—have been long recognized, but the extent of these differences has not been accurately determined. This paper presents some quantitative data bearing on the question of how much superior the blind are to normal persons in mental accomplishments which are naturally relied upon because of the loss of sight. It answers the question, however, only for one group of blind boys in school, and the conclusions reached may not be altogether true of the blind as a class.

The study was made in 1914 in the Houghton Grammar School, the Rindge Technical High School, Radcliffe and Harvard College classes (all in Cambridge, Massachusetts); and the Perkins Institution for the Blind, Watertown, Massachusetts.

I. Objects of the Investigation

The report makes

1. A comparison of the abilities of the Perkins Institution boys with students of normal elementary, high school, and college groups in reproducing in writing the elements of a simple story after hearing it read once. This is known as the "Reproduction Test."

2. A comparison of the abilities of the same groups (with the exception of the elementary grades) in regard to the retention of the elements of the story after an interval of five days. This is known as the "Retention Test."

3. A comparison of the immediate memory of the Perkins Institution boys with normal boys of about the same age in the Rindge Technical High School for lists of letters and figures. This is known as the "Immediate Memory Test."

4. A comparison of the abilities of these two groups of boys in regard to solving a complicated form board puzzle. This is known as the "Form Board Test."

II. Methods of Conducting the Tests

The Reproduction Test

For testing logical memory, the story entitled "The Golden Goose," in Pyle's "The Examination of School Children" was used. The groups examined were the following:

(a) Grades II to VIII, inclusive, in the Houghton Grammar School. Number of pupils examined, 254, there being on the average 36 pupils to a class.

(b) A class in the Rindge Technical High School. There were 20 pupils in the class.

(c) A class in educational psychology in Harvard University. 14 students were tested.

(d) A class in educational psychology in Radcliffe College. 18 students were tested.

(e) A class in the Perkins Institution. There were 19 pupils in the class.

The story was carefully read once to each of the above groups, at different times. After the reading each person wrote on paper all the elements of the story he could reproduce. The Perkins Institution boys wrote with Braille-writers or typewriters. There was no time limit. The tests were uniformly conducted. In all, 323 individuals were examined.

When all the papers were collected, they were examined for the purpose of deciding what should constitute the various elements of the story. There were found to be fifty elements in the complete story. Using that number as a basis, each paper was given a percentage. The charts on opposite page show the results obtained.

In chart I, the percentages of pupils in the various classes capable of reproducing from 67% to 100% of the elements of the story are represented; *e. g.*, all, that is 100% of the blind boys reproduced between 67% and 100% of the story. Whereas, but 60% of the Rindge boys, with whom, in age, training, etc., they are most nearly comparable, could reproduce this much of the story.

In chart II, the average abilities of the several groups are compared. The tops of the columns indicate the average percentage reproduced. The blind boys lead with an average percent. of reproduction of 87.7%, the Rindge boys having an average percent. of reproduction of 69.9%. The Radcliffe and Harvard students have somewhat higher percentages than the Rindge but considerably less than those of the blind.

LOGICAL MEMORY

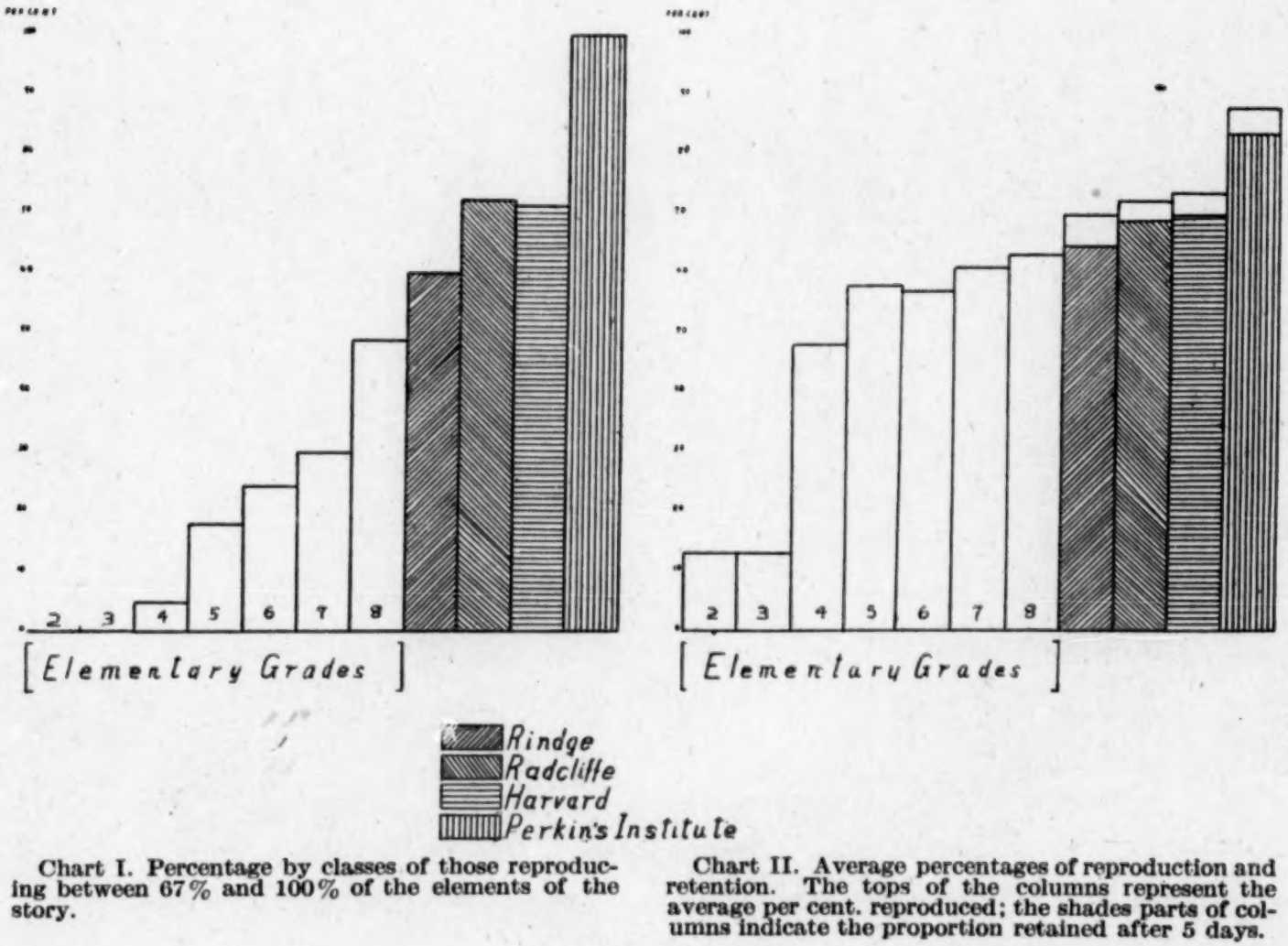

Chart I. Percentage by classes of those reproducing between 67% and 100% of the elements of the story.

Chart II. Average percentages of reproduction and retention. The tops of the columns represent the average per cent. reproduced; the shades parts of columns indicate the proportion retained after 5 days.

The Retention Test

The groups examined for the retention of the elements of the "Golden Goose" were the same as for the test just described except that the elementary grades were not included.

After an interval of five days from the reading of the first test, the persons examined were asked to reproduce again as many of the elements of the story as possible. They had not been told that the test would be repeated. Those who had considered the story since the first writing were asked to indicate that fact on their papers. Their papers were not included in the results of this test. There was no time limit.

These papers were carefully examined, and given percentages as in the first case.

The shaded parts of the columns in chart II indicate that proportion of the reproduced matter which was retained after five days. The actual percentages are as follows: Perkins Institute, 95.9%; Radcliffe, 95.2%; Harvard, 95.1%; Rindge, 92.4%.

The Immediate Memory Test

The groups examined for immediate memory of lists of letters and numbers were a class of boys in the Perkins Institution (not in all cases the same pupils as considered above) and a group of boys in the Rindge Technical School of about the same ages.

There were seven lists in all, four of letters chosen at random and three of numbers chosen in like manner. These lists varied from twelve to fifteen letters or numbers respectively. Each list was read once, then the students reproduced as many of the units of it as possible. The tests were marked I to VII inclusive, the first four being of letters. The Perkins Institution boys used Braille-writers and typewriters for their lists. There was a time limit of thirty seconds. The tests were uniformly conducted.

Incorrect letters or numbers omitted and additional ones were counted as errors in assigning percentages to the papers. Nineteen blind boys and twenty Rindge boys competed in this test. The results obtained are tabulated below. (The numbers are the percentages correctly reproduced.)

Test.....	I	II	III	IV	V	VI	VII
Rindge.....	46.9	46.2	46.5	48.6	49.4	65.7	67.2
Perkins.....	55.2	49.9	46.0	44.1	51.4	44.9	54.4

For example, the Rindge students were able to produce 46.9% of the letters correctly in Test I, while the percent. for the Perkins Institution boys is 55.2. It will be noted, however, that the percents. do not indicate a dominant superiority in the favor of either group, the Perkins boys being as often below as above their competitors in average abilities. There is some evidence of the effect of practice in the course of the seven tests in the case of the Rindge pupils, which does not appear in the results of the blind boys.

The Complicated Form Board Test

The groups were the same as for immediate memory. They were not, however, in all cases the identical pupils. For a test of tactual and kinaesthetic sensibility, a form board puzzle was used into which blocks of various forms exactly fitted into correspondingly shaped depressions. In some cases two or more blocks were required to fill the depression. The Rindge students were blind-folded. The test was given individually in succession.

A preliminary period of thirty seconds was allowed each pupil for the purpose of learning the locations of the depressions and the shapes of the blocks. Except for this, there was no time limit, but the time required in each case to place each block correctly into its proper depression was carefully noted. Each boy's age was noted also. Every attempt or accomplishment of placing the wrong blocks in a depression was counted as an error. The results of this test are shown below by averages.

	Age	Errors	Time
Perkins.....	16 yrs. 8 mo.	3.8	4.2 min.
Rindge.....	17 yrs. 5 mo.	12.6	5.9 min.
Difference.....	+9 mos.	+ 8.8	+1.7

That is, the Rindge boys are nine months older, take one and seven-tenths minutes longer, and make eight and eight-tenths more mistakes than the Perkins Institution boys.

III. Summary

The conclusions which may be drawn from this particular investigation are as follows:

I. The blind boys of the Perkins Institution as a group are superior in the memory for a passage of prose read to them to a normal group of boys of approximately their own age, and to classes of adult college men and women. The extent of this

superiority is shown by a comparison of the averages of the groups in chart II, and still more strikingly by chart I, where the Perkins Institution boys are found entirely in the highest division.

II. The blind as a class retain a somewhat higher percentage of the elements in logical memory than do any other group. This is shown by shaded portions of chart I, which represents the Perkins boys leading with an average of 95.9% of their original ability.

III. The superiority shown in the logical memory of the blind does not manifest itself in immediate memory for numbers and letters. The reason for this difference appears to the writers to be that the immediate memory for numbers and letters is in comparison with the logical memory a relatively unpractised ability in the case of all subjects.

IV. The higher degree of sensibility to touch and to the feelings of movement and position in the blind is demonstrated. Normal boys about nine months older than the blind boys require nearly half again as much time, and make about three times as many mistakes, in solving a complicated form board puzzle.

The study, as a whole, gives some definite notion of the extent to which prolonged special training may develop special abilities.

The blind as a class are trained to listen attentively and their educational system depends on the high development of the sense of touch. They have exceptional need for the development of these senses; for they must remember what is told them or be subjected to numerous inconveniences and difficulties, and they cannot read their Braille books unless their finger-tips are highly trained. For these reasons they devote years to the special training of these senses.

The effect of this training appears in the excellence of memory for the passage of prose read to them. In the case of the immediate memory for isolated numbers and letters, they are likely, however, to receive no more training than ordinary individuals, and they show no superiority. This indicates that their special abilities are limited to the things in which they are especially trained, and supports the results of other experiments in showing how narrow may be the influence of special training. It should be added, however, that the significance of this last conclusion is lessened by the fact that even direct practice in the case of the auditory memory span for numbers, letters, etc., is relatively limited in its effect.

THE WOOLLEY-TEST SERIES APPLIED TO THE DETECTION OF ABILITY IN TELEGRAPHY

EDWARD S. JONES

Chicago, Illinois

An extensive series of tests is being standardized by Mrs. Woolley in Cincinnati for different "age" and "social" groups. Their norms are being more and more carefully fixed. But no direct comparison has as yet been made of the records of ability in these tests with specific abilities of a practical kind. The present investigation carried on at the Vocation Bureau of Cincinnati, is a meager attempt to judge the value of the Woolley tests as indices of future capacity in telegraphy.

A group of boys, in two divisions, employees of the Western Union Telegraph Company were used as subjects. These boys (15 years old) were employed by the company every other week as messengers, and, during the alternate weeks, received instruction in telegraphy in the "Telegraph Boys Continuation School," of Cincinnati, a part of the public school system. The instruction was partly in the hands of Miss L., a continuation school teacher who was adept in telegraph-operating, and partly under the control of Mr. P., an expert main-line operator sent by the W. U. Tel. Co. Both teachers were in constant contact with each boy, and were remarkably successful in stimulating the boys to interested activity.

This school began in March, 1915, and all of the boys included in this study entered the school at that time or very soon afterwards. During the month of August, 41 boys who had been in regular attendance in the school were given the series of tests used by Mrs. Woolley in making up her 15-year-old norms for "working boys." There were 22 of this original number who remained into the month of December, that is, who had had practice in telegraphy for approximately 8 months. The progress of the boys in their work was considered by Mr. P. to be very encouraging, and the degree of skill acquired can be indicated by the fact that the boy judged by him to be the best (although not markedly superior to others) was then capable of taking a regular operating position, and was waiting for the first opening the company had.

In evaluating the telegraphic skill of the different boys, only one type of measurement was used,—the judgments by the teachers of the rank of each individual in the group. Both of the teachers who were with the boys constantly, ranked them in order of merit from best to worst, at two specific times.

(1) A preliminary judgment was made of the original 41 boys, at the time of giving the tests, in August.

(2) A final judgment of rank was made of the 22 boys who remained in the school for the 8 months, up to December. Only these 22 individuals are considered in this study.

This final judgment of ability of the boys is assumed to be a fair measure of the relative ability of the individuals in telegraphy, or better perhaps, their ability to "make good" in this field. In the first place, the teachers were in constant touch with each boy, and had been more or less consciously considering the relative ability of the individual boys for 4 months. Secondly, they were asked to make their final judgments largely on the basis of their opinion of the "final" operating capacity of the individual boys. They consequently gave due consideration to the interest and effort aspect of the work.

Since all of these 22 boys had worked during the same period of time as messengers in the W. U. Tel. Co., it was thought of interest to go to the men who had them in charge and get a judgment from them as to the relative efficiency of each boy as a messenger. Two men who had supervised this messenger-service ranked them accordingly. There were then, in all, five sets of judgments of rank of the 22 individuals who had practiced telegraphy for 8 months,—a preliminary and a final judgment by both Miss L. and Mr. P. and a messenger service judgment. Neither of the ranking individuals was in any wise aware of the grading of the others.

The educational background of the individual boys is significant. Only 2 of the 22 boys had completed the 8th grade of school work, while the rest were retarded in school work in varying degrees. Two, for instance, were attending special 4th grade classes. The "grade-completed," then, will be considered as an index of the educational status of the individuals.

The judgment of the value of the Woolley tests in indicating telegraphic ability is made in two ways. (1) A series of correlations was found between the various tests and the judgments of the teachers, by means of the Pearson "rank" method of

determining the correlation index ($\rho = 1 - \frac{6d^2}{n(n^2-1)}$), reduced to the r-equivalent by the formula $r = 2 \sin (\frac{\pi}{6} \rho)$. (2) For the purpose of a more accurate analysis of the individuals a table was made up showing the relative standing of the individuals in estimated operating-ability together with their rating in the tests on the basis of the Woolley scales (published in the JOURNAL OF EDUCATIONAL PSYCHOLOGY, November, 1915). Seven boys out of the 22, who had worked for 8 months, were considered by Mr. P. to be failures, absolutely incapable of ever making desirable telegraph operators. The question presents itself; have we, on the basis of the standings of the boys in terms of the Woolley norms, a means of sorting out the desirable from the undesirable candidates in such an ability?

(1) There was close agreement between the judgments of the two teachers, especially in the final rankings made ("r" = .81 in the case of the preliminary judgments, and .91 for the final judgments, with probable errors of .052 and .025 respectively). Between the first and final judgments of L. the correlation index, "r," was .68, while that of P. was .70 (.88 when the judgments were combined into one).

The correlation index was found between each teacher's ranking (and the combined ranking) and all of the measurements used in the case of 15-year-old boys by Mrs. Woolley. Many of the indices are so small they are not worth tabulation, and only the correlation indices of the final combined ranking of the two teachers will be mentioned with these cases. In cancelling the "m"s on the Whipple small-letter cancellation blanks, for example, both the accuracy and the time-index showed a slight negative correlation with telegraphic ability ("r" = —.13, and —.16 respectively). In the substitution test measurements, the indices were all negligible in amount with one possible exception. When the total time taken on the three learning pages was considered correlation index with telegraph ability was "r" = .39. This test has been considered a typical learning test, the object being to learn a set of symbolic connections during three pages of writing and on a fourth page make appropriate substitutions from memory. Curiously the "r" between the accuracy of the final memory page and the teachers' final ranking was —.08.

The immediate memory tests,—reproducing immediately 2 sets of 7, 8, and 9 place number series which are exposed to the subject,—showed low correlation indices with estimated operating ability when the different length sets were considered alone, but a fairly high index when all were combined. The "Opposites" test gave substantial indices of correlation, the "accuracy" standing especially high with Mr. P.'s ranking. The various measurements of the "sentence-completion" test were all well correlated with the teachers' rankings with the exception of the "number of ideas" written, whose correlation index was .39. This test, designed to measure a subject's ability to "complete sentences quickly" (whose beginnings are exposed), to write these sentences correctly, and to use a large variety of ideas in the time taken, seems to be widely applicable as a general intelligence test.

Three additional tests were tried without positive advantage. The times taken for the Healy and Fernald puzzle box and for the Healy small "A"-formboard gave correlation indices with the teachers rankings of —.01 and .05 respectively; and a recognition test,—in which previously exposed geometrical forms were to be identified after their mixture with other similar forms, —gave an index of —.08. It was thought previously that this last test might relate closely to the capacity needed in telegraph operating.

The six test measurements most highly correlated with telegraph ability, as estimated by the teachers, are tabulated below in connection with their correlation indices with the preliminary and final judgments of the teachers' estimates (when these are combined), also with the final judgment of each individual teacher, and with the grading as given by the messenger-service supervisors. Finally the six highly correlated tests have been pooled together,—their average standings taken for each individual on the basis of their values in the Woolley norms,—and this result correlated with each of the rankings. Here a high index of correlation is shcwn, especially in the case of P's final judgments, although this is not very superior to the relationship between telegraphic ability and the "school grade-completed" (also included below).

TABLE I.

Correlations

	Combined estimate of teacher		Final ranking of		Efficiency
	Preliminary	Final	P.	L.	as messenger
All Woolley-tests, combined percentiles...	.54	.52	.54	.51	.26
Immediate memory, ave...	.55	.52	.43	.55	.24
Opposites test, Acc.....	.58	.59	.66	.41	.37
Opposites test, Index.....	.36	.51	.55	.51	.21
Sentence completion test, No. correct sentences...	.36	.52	.53	.55	.19
Association speed.....	.37	.52	.56	.56	.39
Index, Ideas time.....	.51	.48	.53	.39	.54
Ave. of 6 selected tests (from norms).....	.61	.79	.81	.76	.44
School grade completed...	.67	.77	.79	.72	.30

In general, it should be said that the "probable error" values vary from .151 for a zero value of "r" to .126 where "r" equals .40 (the lowest value of "r" for a reliable indication of relationship), to .113, .094, .077 and .054 for values of P.E. when "r" equals .5, .6, .7, and .8 respectively. Finally, it is interesting to note that the correlation between the final combined ranking for telegraphic ability and the ratings given by the messenger service supervisors was negligible, ("r" = .11). This shows that a general industrial efficiency factor was not conspicuous, and that the telegraphic ability as measured is a fairly specific function.

(2) For the purpose of showing more definitely the diagnostic value of the six most highly correlated measurements the following table (II) has been devised. As stated above the main line expert, P. insisted that 7 of the boys were incapable of ever attaining sufficient ability to hold operating jobs. Miss L. was not so dogmatic but agrees very closely with P. in her judgment of the inefficient. The standings of the "successful" individuals, the 15 ranked the highest, are contrasted with the standings of the "failures," the 7 lowest of the group. The numbers included below in parenthesis indicate the "decile" groups into which the individuals fall in the different tests, on the basis of the 15-year-old "working-boy" norms established by Mrs. Woolley. That is, (2) indicates that the subject stood between the poorest 10% and 20% points in the records of the working-boy group tested at Cincinnati. The other numbers refer to the rank of the individuals in the group of 22 boys, *e. g.*, "2" indicates that the individual was the next to the best.

TABLE II.

Ranking of Individuals

Tested Boys Who had Remained in School for 8 Months

Ranking of	Successes															Failures						
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.	S.	T.	U.	V.
Mr. P.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Miss L.	1	2	3	7	5	10	11	12	8	4	9	6	14	13	16	15	21	19	17	18	22	20
School-grade completed	6	6	7	8	7	8	7	6	6	7	7	5	5	6	3	5	5	3	5	5	5	4
Decile value																						
All tests	(8)	(1)	(10)	(8)	(4)	(5)	(8)	(9)	(1)	(10)	(6)	(6)	(7)	(5)	(1)	(5)	(3)	(1)	(5)	(3)	(3)	(1)
Imm. memory	(4)	(4)	(8)	(4)	(6)	(3)	(2)	(7)	(1)	(10)	(2)	(5)	(3)	(6)	(2)	(5)	(1)	(3)	(3)	(3)	(3)	(3)
Opposites, acc.	(3)	(6)	(9)	(8)	(6)	(9)	(8)	(6)	(2)	(9)	(10)	(1)	(3)	(3)	(4)	(2)	(2)	(1)	(1)	(3)	(3)	(1)
Opposites, Index	(8)	(1)	(8)	(3)	(3)	(2)	(8)	(2)	(4)	(8)	(2)	(4)	(6)	(3)	(5)	(1)	(3)	(1)	(1)	(1)	(1)	(1)
Sentences																						
No. correct	(2)	(8)	(8)	(8)	(8)	(4)	(8)	(4)	(2)	(8)	(8)	(1)	(8)	(2)	(2)	(2)	(4)	(1)	(4)	(8)	(1)	(2)
Ass'n speed	(10)	(2)	(3)	(10)	(8)	(2)	(10)	(8)	(7)	(4)	(8)	(4)	(6)	(1)	(4)	(5)	(5)	(1)	(2)	(1)	(2)	(1)
Time-index	(9)	(3)	(4)	(7)	(8)	(2)	(10)	(9)	(2)	(8)	(3)	(7)	(6)	(4)	(5)	(2)	(4)	(1)	(1)	(1)	(6)	(1)
Rank acc. to six tests	6½	10	3½	3½	5	12	2	6½	16	1	8	12	9	14½	12	17½	14½	22	20	17½	19	21

It is plain that no one of the test measurements is infallible in its ability to eliminate the misfits. The opposites test and the combination of the six selected tests come closest to this. One exception to this finding, individual "I" might be considered in passing. This boy was large for his age, very serious and interested in the work. His natural slowness was compensated for by an especially pronounced effort. Other similar though lesser discrepancies can be accounted for by language and educational differences.

Discussion and Conclusions

(1) There seems to be no clear indication of relationship between efficient messengers, as rated by the company officials, and ability as measured by the mental tests. The measurement of the "time-index" in the sentence test is a possible exception to this.

(2) The type of ability evidently demanded in telegraphy seems to be fairly highly correlated with ability as measured by certain of the psychological tests. When six of these records are pooled together the correlation of the result with the ability to telegraph (as judged by the main-line expert) is significantly high ("r" = .81). In spite of the comparatively small number of individuals tested, it seems reasonable to conclude that the use of the tests for predicting probable success in this field is warranted. This is especially true in view of the fact that the correlations between the first and final rankings of the individual teachers was less than the above amount, (r = .68 and .70 for L. and P. respectively). In other words, by immediate testing of a group of boys with certain selected tests, (only 3 in this case) it seems probable that more can be told regarding their future telegraphic ability than by judgments of individual teachers of telegraphy 4 months after they have had the boys under their direction.

(3) It is impossible to predict in advance what tests will correlate highly with special kinds of abilities. The substitution test measurements and the recognition test are striking evidences of this, in that they seem to indicate no close relationship with the ability in question; while the opposites test, and sentence test measurements give high correlation indices with estimated telegraphic ability.

(4) It is very significant that "school-grade-completed" corresponds so highly with ability in telegraph operating. This is true in spite of the fact that the boys were recruited from all parts of the city, from public and parochial schools, and that in the case of Mr. P., at least, there was no knowledge of the exact grades which these boys had completed. It seems probable that boys who have not passed the 6th grade at the age of 15 will rarely make good in telegraphy.

(5) Finally, it can be seen from the second table that users of psychological tests can never afford to be mechanical. Language difficulties and striking discrepancies in applied effort and interest will always make differences. The remarkable thing is that without eliminating these various factors in the least we have such high correlations between the final judgments of telegraphic ability and the selected test results. By taking account of school standing, and records from selected tests, it ought to be possible to eliminate many individuals from special courses of this type to the benefit of the school and the individual.

PUPILS' ESTIMATES OF TEACHERS

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Is the pupil's opinion or the estimate of the superintendent the more accurate gauge of the teacher's efficiency? The superintendent is, of course, capable of more mature judgment, but the pupil through intimate daily acquaintance with his instructor, possesses more data and evidence upon which to base a decision. No doubt the ideal teacher of whom so much has been said and written fulfils the requirements of both.

The results of investigation by Boyce, Ruediger and Strayer[1] indicate that from the point of view of the supervisor the most important qualifications of a teacher are instructional skill, discipline, initiative and experience. According to Sherman Littler,[2] the usual reasons for the failure of teachers are poor discipline, weak personality, lack of teaching skill, lack of interest, laziness, failure to coöperate or poor health. It was found by Miss Moses[3] that among twenty-six school systems the ten most frequent causes of failure were poor instruction, weakness of personality, lack of interest, weakness in discipline, lack of sympathy, inability to coöperate, unprofessional attitude, weakness in knowledge of subject matter, disloyalty, immorality, and poor health. Buellesfield[4] concludes that weakness of discipline, lack of judgment, deficient scholarship and poor methods of instruction are the chief reasons for lack of success. From these causes of failure it is evident what qualifications those unsuccessful teachers should have possessed.

W. F. Book[5] investigated the subject from the point of view of 1067 senior high school students from eight different states, who were asked to write a composition on High School Education, including a discussion of their teachers. The traits of character most appreciated are included in the terms sympathy and kindness, good humor, patience, sociability, firmness and courtesy—in short, the most fundamental social virtues.

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[1] *Methods for Measuring Teachers' Efficiency*—(Pub. U. of Chicago Press) 1915.

[2] *Causes of Failure Among Elementary School Teachers*—School and Home Education, March, 1914.

[3] School and Home Education—January, 1914.

[4] *Causes of Failure Among Teachers*—Educational Administration and Supervision, September, 1915.

[5] *The High School Teacher from the Pupil's Point of View*—Pedagogical Seminary, September, 1905.

Another early investigation of the subject from the pupil's standpoint was made by Kratz,[6] who collected from 2411 girls and boys in grades one to eight inclusive, descriptions of the best teacher they had ever had, without naming her. The qualities mentioned in order of preference are kindness, patience, politeness, neatness and discipline.

The usual standard efficiency records and the expected requirements of employers place personal appearance, health and voice first. If by appearance and voice are meant the visible and audible signs of true character, and not mere superficial externals, no doubt these requirements are very closely related to the requirements of pupils. Very few of the boys and girls who were questioned, however, demanded any one of those qualities in the form designated. Reasonable health is without doubt desirable and necessary in any kind of work. A conspicuous omission in all the efficiency records obtainable is a sense of humor, which in the school room is often all that resolves a difficult complication in discipline. Fortunately the value of this mental tonic is more highly appreciated among pupils.

To test the conclusions already published and to carry the investigation a step further, data were collected by the writer fron one hundred thirty-nine high school girls, two hundred fifty-three high school boys, and one hundred fifty normal school students, who were asked, without previous warning, the question, "What are the five or six best qualities of the best teachers you have ever had?" The answers were written without discussion, during a class period, and were passed in unsigned, in order that every statement might be thoroughly candid. The ten qualities receiving the largest average percentage of votes were considered sufficient for a working basis. In order that one convenient term might be used to designate each quality, wordy expressions were condensed or synonyms construed, but no meanings were changed or interpreted too broadly. In many instances qualities were repeated by the same student, or less than the number of characteristics requested were given. "Humor," for example, was expressed as "Loved fun," "Jolly," "Told funny stories," or "Appreciated a joke." Pupils in the elementary school were not interrogated. Inexperience, lack of judgment, errors of imagination, and vagueness of expression

[6] *Observations in the School Room*—Chap. 5 (Ed. Pub. Co.)

make it difficult to obtain reliable data from most pupils below the high school.

The percentages of frequency and their distribution show agreement that the ten most important qualities are fairness, kindness, sociability, sense of humor, good temper, ability to discipline, neatness, patience, adequate preparation, and ability to impart information. With girls, kindness ranks first. Among boys fairness is the most appreciated. This sex difference is probably due to training and experience rather than original nature. Sociability is more appreciated by normal school students than by either high school girls or boys. Discipline is held in much esteem by high school girls, less by boys, and still less by normal school students, whose deportment and business attitude toward study do not usually demand it. Owing to established precedent neatness receives more emphasis from girls than from boys. Patience, which is appreciated by all, ranks highest with high school girls. Clearness of explanation is demanded by high school pupils, especially by girls, no doubt because of the difficulty of new subjects studied in high school for the first time. A strong desire for direction and encouragement is evidenced by all.

Some of the qualities which received an average of one vote or less in each of the three groups were health (offset by one boy who stated that the best teacher he ever had was ill half the time), being up-to-date, well-dressed, refined, practical, definite, natural, self-confident, broad-minded, systematic, experienced, faithful, and showing "A sportsman-like attitude toward life." A small percentage mentioned interest in work, strong personality, alertness, resourcefulness, interest in outdoor sports, a business-like manner, confidence in pupils, an entertaining way of teaching, punctuality, politeness and good judgment.

A few expressed themselves at some length and with considerable show of feeling. "Did not make us stay after school," said one. "Treated me well and told me how to do the examples. Gave me a chance to make my lessons up," remarked another. "Showed that they liked their job," ventured a third. Others added, "Because she was always square and did not have any pets"; "Never gave too much home work"; "He treated me with respect and was polite and courteous"; "Because she smiled once in a while"; "Lent me his knife"; "Didn't get mad the first time but gave a fellow a chance"; "Acted as one of the class,

not as a more learned being"; "Never made a promise but she fulfilled it." Faults strongly condemned are favoritism, hypocrisy, sarcasm, lack of sympathy, lax easy methods, and lack of confidence in pupils. "Let a pupil see that you believe in him and he will seldom disappoint you," said one boy. "What we get in high school," wrote one of the girls, "depends on the teacher we have," which is an echo of Emerson's dictum, "It makes little difference what you study in school, but it is in the highest degree important who your teacher is."

More evident agreement is noticeable among the girls than among the boys. Most of the statements volunteered by only one individual were contributed by boys, girls expressing less individual opinion. This accounts for the fact that the comparison-distribution chart is more depressed for the boys, in spite of the fact that their group contained a larger number of individuals than occur in either of the other two accompanying groups. This general agreement among girls may be the result of their usual habit of discussing people at greater length and in more detail with one another than is customary with boys. An added factor might be the strong imitative tendencies of girls, who often acquiesce with popular opinion.

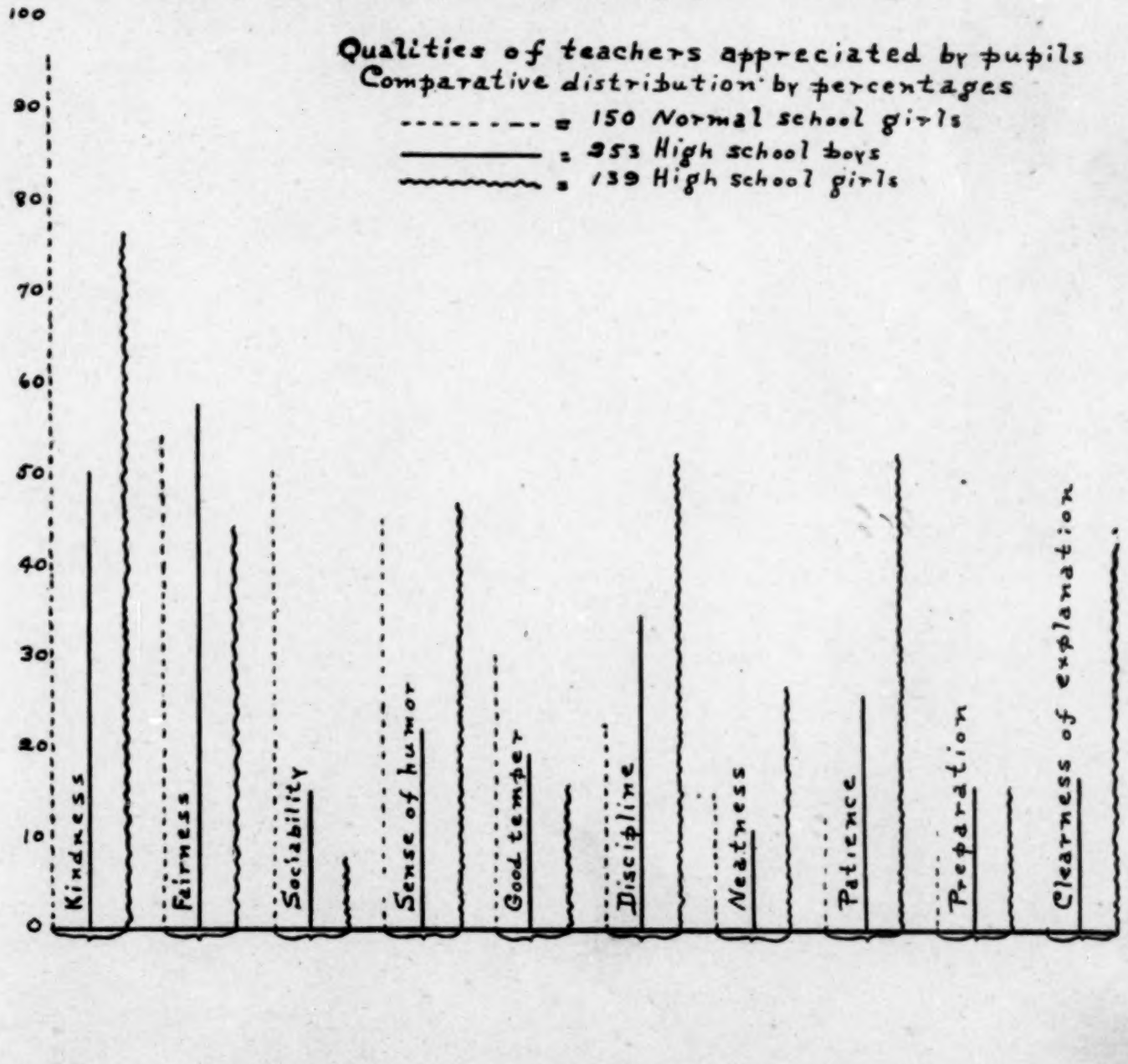
On the whole, no sex preference is emphasized. The feminine personal pronoun is used oftener than the masculine in describing favorite teachers; probably because most of the teachers in the schools are women. Also, there appears to be no appearance qualification. Some appreciation was expressed for the young teacher, for the reason that she is "Full of life," "Up-to-date," and "In sympathy with boys and girls."

In general, the results of this study agree closely with investigations already made. In fact, many of the descriptive expressions characterizing favorite teachers were found to be identical with those appearing in former experiments. A few recurring frequently in all the investigations are, "Is one of us," "Jolly and pleasant out of school," "Not afraid to laugh," "Trusted us and put us on our honor," "Did not spy on us," "Took an interest in us out of school," "Made recitations interesting," "Encouraging and cheerful," "Always had something pleasant to say," "We always studied our lessons for her," "We always did our best for her."

Very close correlation exists between the opinions of boys and of girls, of high school and of normal school students. Because

the number of pupils in the different groups is unlike, percentages of frequency are used, for the sake of uniformity, to indicate the popularity of each quality. By the Pearson product-moments formula, the correlation between the opinions of high school girls and high school boys is .80. Between high school girls and normal school girls is .88. The probable error for the first correlation is about .05, and for the second .07. Similar closeness of comparison has been indicated by casual conversation with over twenty teachers of experience, who, after the lapse of many years, recall as the qualities of their former best instructors, the same characteristics appreciated by the pupils whose reports have served as the foundation of the foregoing experiments. It seems convincing that these requirements are essential.

If the lists of qualifications demanded by employers, the causes of failures, and the requirements of pupils are compared, the



parallelism of desirable characteristics is no doubt closer than it seems, because of the similarity of idea behind loose, general terms, which at first glance may be interpreted as indicating different qualities. One requirement which appears in every such list of requisite qualifications is discipline. This in its best and broadest sense, perhaps, includes all the others. Without juggling with terms, however, the fact remains that pupils appreciate most the ordinary virtues fundamental to character. Employers, because they are often obliged to select teachers on chance impression, and are unable to observe instructors' work oftener than semi-occasionally, are forced to rely upon appearances, usually without even the assistance of standardized methods of rating the teacher's fitness for the work. Since all this is true, it behooves the instructor of youth to endeavor to fulfil all the requirements of both supervisor and pupil, that she may be ranked as one of that noble company of ideal teachers of whom the published proceedings of educational associations are always full to overflowing.

Pupils' Estimates of Teachers *Ranks and Percentages of Frequency*

Qualities	150 Normal School Girls		253 High School Boys		139 High School Girls		
	Rank	Percent. Frequency	Rank	Percent. Frequency	Rank	Percent. Frequency	Average Frequency
Kindness.....	1	94	2	51	1	75	73
Fairness.....	2	54	1	56	5	44	51
Sociability.....	3	50	7	17	10	7	25
Sense of Humor...	4	45	5	22	4	47	38
Good Temper....	5	30	6	19	8	14	21
Discipline.....	6	23	3	35	2	52	37
Neatness.....	7	15	10	11	7	27	18
Patience.....	8	13	4	26	3	50	30
Preparation.....	9	11	8	15	9	14	13
Clearness of explanation....	10	0	9	15	6	43	19

CORRELATIONS

Normal School Girls and High School Girls	High School Boys and High School Girls
$o_1 = 27$	$o_1 = .15$
$o_2 = 21$	$o_2 = .21$
$r = .88$	$r = .80$
P. E. = .05	P. E. = .07

COMMUNICATIONS AND DISCUSSIONS

TRANSFER OF SPELLING VOCABULARY

In 1912–1913, the writer and four advanced students in education at DePauw University made a minor investigation regarding the transfer of spelling vocabulary. The problem specifically stated was, "To what extent do students use the accurate spelling vocabulary of their themes in English in themes in sociology?" Papers containing such themes were collected from the two departments concerned. Thirty students were found in the two courses for whom there were papers in both subjects. These students are indicated by number in the table following. For example, student 4 was represented by a theme in English and one in Sociology, for student 20, there was a theme in each subject, etc., etc. Thus it was possible to compare the work of the same individuals but in different types of themes. For example, it was possible to compare the manuscripts of student 4 in both subjects. It was the original plan to compare such themes as to several different matters such as writing, spelling, punctuation, etc. The comparison as to writing was made, but the resulting data have never been organized. The comparison as to spelling was made. The method used was as follows: The four students of education, hereafter known as Ni., Sand., Ay., and Pr., examined the same manuscripts. But they were not required to examine the whole manuscript, or the same portions of them. Ni. examined 5 pages of the manuscripts in English and sociology for student 7, while Sand., examined 4 pages for each theme for student 7. One examiner studied the same number of pages in the two themes as he examined them, but the pages were not necessarily the same pages examined by the others for the same themes. The numbers of pages actually examined are shown in the columns 2, 5, 8, and 11 of the following table. The English themes had been very carefully marked by the instructor of English and all misspelled words were indicated by red ink. No marks for misspelled words had been placed on the theme papers in sociology. The instructor in English had given even more than the usual stress to the necessity of accuracy in usage of spelling and other matters of elementary composition. The instructor in sociology had given practically no attention to the status of English in such themes, unless he found one in very inferior condition. The results of the

investigation are given entire in the following table. This table reads as follows: Ni. found one error in one page of English and one error in one page of sociology in the themes for student 4. Sand. found three errors in four pages of English and nine errors in four pages of sociology in the two themes written by student 8. Ay. found one error in five pages of English and three errors in five pages of sociology in the themes written by student 33. Pr. found the same facts for student 33.

RESULTS

No.	Ni.			Sand.			Ay.			Pr.		
	Pp.	Eng. Errors	S-Errors	Pp.	Eng. Errors	S-Errors	Pp.	Eng. Errors	S-Errors	Pp.	Eng. Errors	S-Errors
4	1	1	1	1	1	6	1	1	0	1	1	3
7	5	0	3	4	1	4	5	4	3	5	1	2
8	5	3	2	4	3	9	5	2	4	5	1	0
9	1	2	1	4	1	40	1	1	0	1	1	2
11	5	1	0	4	1	15	5	1	1	5	0	0
12	1	1	0	4	1	18	1	1	5	1	1	0
13	1	1	1	4	0	3	1	0	1	1	0	1
20	5	0	2	4	1	4	5	1	2	5	0	0
22	5	0	0	4	0	4	5	0	0	5	0	0
23	5	0	2	4	3	2	5	0	0	5	0	3
24	10	0	0	4	0	12	10	0	1	10	0	1
28	5	0	0	4	0	40	5	0	2	5	0	1
30	1	1	3	4	1	16	1	1	1	1	0	0
32	1	0	0	4	0	10	1	0	0	1	0	0
33	5	1	4	4	0	1	5	1	3	5	1	3
39	5	4	6	4	3	3	5	4	1	5	1	1
40	1	0	0	4	0	1	1	0	0	1	0	0
51	1	0	2	4	0	0	1	0	1	1	0	0
52	1	0	1	4	0	1	1	0	2	1	0	1
55	5	0	4	4	0	15	5	0	0	5	0	1
56	1	0	0	4	0	5	1	1	0	1	1	0
59	5	1	2	4	2	1	5	1	1	5	1	1
61	5	3	1	4	1	0	5	3	2	5	1	1
68	5	0	2	4	0	0	5	0	0	5	0	0
79	5	0	0	4	0	3	5	0	0	5	0	1
80	5	3	1	4	0	4	5	5	1	5	1	2
90	2	2	3	4	2	3	2	2	2	2	0	0
92	1	0	0	4	0	18	1	0	1	1	0	0
95	1	1	2	4	1	0	1	1	0	1	1	2
98	5	1	0	4	1	2	5	1	2	5	0	0
	104	26	43	117	23	240	104	31	36	104	12	26

From the above detailed table the following summaries in totals, averages, and percentages has been prepared.

No. of themes compared	No. of pp. compared	Errors—Misspelled words Sand.	Ni.	Ay.	Pr.	Corrected totals	Averages
30 English.....	426	23	26	31	12	92	23.00
30 Sociology.....	429	240	43	36	26	245	61.25
Actual increase in errors in sociology themes.....		117	17	5	14	153	38.25
(After correction)							
Percentages of increase in errors (Corrected).....		519%	65.4%	16%	116.6%	166.3%	166.1%

The total number of errors found by Sand. in sociology themes is very much greater than the totals found by the other examiners. This was due to three factors: (1) Sand. counted each repetition of a misspelled word as an error. The others did not. (2) Sand. examined 13 pages more of manuscript than the other three examiners. (3) Sand. was much more accurate in discovering misspelled words for he had had more years of experience in general, several years' successful teaching experience, and had practiced to a considerable extent the detection of misspelled words. The others had not. The other three found an average of 35 errors in 104 pages, or one-third error per page. On this same basis, the total for Sand. would be 39 errors for 117 pages. A fair estimate of the increased number of errors found by Sand. due to his greater skill is judged by the writer to be one error per page. This would account for 117 errors, and would make the total for Sand. (39 plus 117) 156. This would make the error due to repetitions be about 84 (240–156). Probably this should be 100 rather than 84. It is held, then, that the total for Sand. is approximately 140 rather than 240. This is the correction referred to in the table above. On the other hand, it should be recognized that the unskilled examiners must have overlooked many misspelled words. If, then, our estimates for the total errors found by Sand. are too high, they would be counterbalanced to some degree by the inaccuracy of the others in the opposite direction.

There were then, approximately 160% more misspelled words in the sociology themes than in the English themes. *In other words, there was a very general tendency to lower the standard of efficiency in spelling used in the sociology themes.* In matters of punctuation and capitalization a beginning of a study was made. Here, too, a similar tendency was observed.

The writer believes that this minor study shows a very prevalent tendency in the effectiveness of the teaching of English in high schools and colleges, although the investigation made concerned college students only. As he interprets the situation, it represents a failure to

secure habits which transfer, or ideals which are consciously generalized. As such, it suggests the following: (1) teachers of English should strive to secure such transfer; (2) there should be a very much greater coöperation in the teaching of English. Had the instructor in sociology placed emphasis upon correct spelling, why should the students not have had a stronger tendency to spell correctly? (3) if such conditions exist as to spelling, the very *content* of one phase of the English language, what must be the conditions regarding the transfer of the more intangible elements of the mother tongue. It is probably easier to secure transfer of *content* than of some other elements. Hence, it is probable that many of the values of English are being realized only in a very minor degree.

A. R. MEAD.

Ohio Wesleyan University.

ABSTRACTS AND REVIEWS

ROBERT M. YERKES, JAMES W. BRIDGES, AND ROSE S. HARDWICK. *A Point Scale for Measuring Mental Ability.* Baltimore: Warwick and York, Inc., 1915. Pp. 218. $1.25.

What is the reason for the remarkable influence which the Binet-Simon scale for the measurement of intelligence has exerted on the educational thinking of the civilized world during the past five years? Such an instantaneous and general response to a psycho-educational mode of procedure challenges attention. Undoubtedly many factors have contributed to bring the Binet tests into prominence, but one of the most powerful is the conception of mental age. Chronological age has ever afforded the most convenient indication of physical and intellectual maturity. Moreover, it is generally recognized that in the young child increase of years brings with it increase of wisdom. Assuming that for each advancing year of chronological age there is a corresponding increment of intelligence, and assuming further that by selected groups of exercises we can detect these increments of intelligence, it becomes an interesting and important task to determine the mental age of individual children and to ascertain what tests are best fitted to reveal the degree of mental maturity. It is along these two lines that work with the Binet scale has progressed.

The authors of the present book refuse to accept the fundamental assumptions of mental age. By the calendar the interval between the fourth and fifth birthdays is equal to the interval between the fourteenth and fifteenth birthdays, but it is certain that the increments of intelligence are by no means the same. We have no evidence from the Binet tests or from any other source that the development of intelligence is regular. All that we know is that certain exercises are correctly performed by a considerable number of children of a given chronological age, that they are not so well performed by children of a lower age, and that children of a more advanced age show on the whole a higher percentage of correct responses. Moreover, the scoring of mental age by the Binet tests proceeds on the "all-or-none" principle, and entirely ignores qualitative differences. On these and other accounts the authors have rejected the mental age conception, and have devised a point scale consisting of twenty exercises, so weighted for quality of response as to give a maximum score of one hundred points. There exercises are taken almost exclusively from the Binet list, and all of them are given to each individual tested. The degree of intelligence is indicated by the number of points gained,

and is determined on the basis of norms derived from the examination of large groups of children of a particular type.

The book contains a description of the point scale and its construction, directions for its use, a comparison of the point scale with the Binet scale, the results of the application of the scale to more than seven hundred public school children, the derivation from these results of norms for age, sex, linguistic, and social status, a discussion of the limits of applicability of the scale and the reliability of the results obtained from its use, an account of the examination of 175 patients of the Psychopathic Hospital by means of the scale, suggestions for the revision of the scale on the basis of the results already obtained, materials and directions for the revised scale, and a brief discussion of the outlook for a universally applicable point scale for mental measurement. The point scale is claimed to be superior to the Binet scale in that, in addition to the arguments indicated above, "it is capable of giving results of ever-increasing reliability and precision as data accumulate and norms are established," whereas the Binet scale is fixed from the outset. The point scale minimizes the personal equation of the examiner, reduces the number of doubtful cases, works with a smaller amount of testing material, and is more readily extended to the testing of adolescents, and of persons exhibiting special forms of mental instability.

The fundamental idea of the point scale commends itself to the reviewer as sound and valuable. It is more flexible than the Binet method, and the results obtained are more amenable to statistical treatment. The extent to which it has been adopted in the short time that it has been before the public is evidence that it possesses elements of popular appeal. Nevertheless, the present point scale seems to be defective in two important respects. First, the twenty tests of the scale are taken, with one exception, from the Binet list. But it has been pointed out again and again in criticism of the Binet scale that there is no guarantee that these particular exercises are highly indicative of intelligence. Three of the tests, memory span for words, for digits, and for designs, are memory tests. But a child might be very intelligent, might indeed have a good memory for really useful types of knowledge, and yet make a poor showing in these isolated materials. The child who is unable to count backward from twenty is surely lacking in a certain type of intelligence, but it would seem that a child might perform this task and still be very unintelligent. In other words, we are wofully ignorant as yet about what constitutes intelligence, and about the kind of task that indicates the degree of its presence. Opposites tests and completion tests have been shown to correlate highly with intelligence as it is

ordinarily understood, but neither of these is included in the point scale list, and as to the diagnostic value of the tests found there we know little or nothing. A point scale on the basis of twenty tests each with a known degree of correlation with the common acceptation of intelligence would afford a starting point in which we might place some confidence.

In the second place, the distribution of points to the individual tests seems to be an entirely arbitrary proceeding. Each test is assigned from three to eight points, partly on the basis of the number of questions in the test, partly perhaps on an assumed relative difficulty of the test. But surely the ability to remember four digits is not to be compared with the ability to define "justice," yet each receives two points credit. Again, who knows the relative difficulty of remembering four digits and seven digits? The former is given two points credit, the latter five.

Some of those who have used the Binet scale have become so attached to it as to regard it with a sort of religious veneration, and consider supplanting it with something else almost a sacrilege. In the opinion of the reviewer the Binet scale is a rough, crude, clumsily constructed instrument, which has, nevertheless, served a most useful and valuable purpose in stimulating interest in mental measurements. The Yerkes point scale is an interesting and important step in the refinement of that instrument. But for a genuine, scientifically valid point scale we need much more extentive studies on the correlation of specific tests with various aspects of intelligence, and on the relative difficulty of these tests compared with each other.

J. C. B.

IRVING FISHER AND EUGENE LYMAN FISK. *How to Live.* New York and London: Funk & Wagnalls Company, 1916. Pp. xxiii, 345. Cloth, $1.00; linen, $0.50.

Here is a remarkable book that should be in every school library and in the hands of teachers and parents where possible. It is the latest authoritative pronouncement and an outline guide in hygiene gotten up by the Life Extension Society for the purpose of lengthening life and making it more wholesome. Today it is the hand-book of preventive medicine. This book is the ounce of prevention which is worth a pound of cure.

"Thoroughly carried out, individual hygiene implies high ideals of health, strength, endurance, symmetry and beauty; it enormously increases our capacity to work, to be happy, and to be useful; it develops not only the body, but the mind and the heart; it ennobles the man as a whole."

C. E. S.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

INCLUDING EXPERIMENTAL PEDAGOGY, CHILD PHYSIOLOGY AND HYGIENE, AND EDUCATIONAL STATISTICS

Published monthly except July and August by

WARWICK & YORK, INC.

LANCASTER, PA. BALTIMORE, MD.

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The Journal is issuing a series of Monograph Supplements for the publication of more extensive researches in educational psychology. For details prospective contributors may apply to Guy Montrose Whipple, University of Illinois, Urbana, Ill.

The price of the Journal is $3.00 per year of ten monthly issues. Foreign postage is 20 cents extra for Canada and 30 cents for other countries in the Postal Union.

Subscriptions and correspondence concerning business matters should be sent to Warwick & York, Inc.

VOLUME VIII JANUARY, 1917 NUMBER 1

EDITORIAL

TAKING ACCOUNT OF STOCK

As the JOURNAL OF EDUCATIONAL PSYCHOLOGY enters upon its eighth year there is satisfaction in noting that the cause for which it has consistently stood, the application of experimental methods of investigation to educational problems, is held in increasing esteem by the educational public. To boast of the influence it has wielded in furthering the experimental movement would be unbecoming, but the number of references to its pages in current text-books and general treatises is conclusive evidence that it has rendered important service as an avenue of expression to those who are engaged in productive work in education.

The past year has been characterized by especial activity in the applications of psychology to business and vocational education. The establishment of the Bureau for Salesmanship Research at Pittsburgh under the direction of Scott, Bingham and Whipple, the work of Woolley at Cincinnati, Adams at Michigan, Hollingworth and

others at Columbia, and the propaganda of Muensterberg of Harvard, so suddenly struck down in his prime, bear witness to the interest which this type of investigation arouses. The new *Journal of Applied Psychology*, soon to be launched at Clark University, will doubtless quickly win recognition as the leading organ of publication for studies of this sort, and we shall gladly extend a hearty welcome to our youngest sister in the family of psychological periodicals.

In mental tests noteworthy progress has been made during the past year in two directions. First, our knowledge of psycho-motor activity has been enriched and extended by Wallin and Dearborn in their modifications of the form board and the establishment of norms of performance in its use, while Kelley in his constructive ability test has opened up a new field for the quantitative estimation of inventive capacity. Secondly, measurements of general intelligence have been greatly advanced by Yerkes and his co-workers on the point scale, by Terman in his thorough-going revision of the Binet scale, and by Saffiotti in his summary of the work which has been in progress for several years in Italy. It might justly be said that there is no department of psychology or education in which there is more valuable productive work going on than in measurements of intelligence.

In the narrower domain of education Starch has endeavored to bring together the scattered contributions to educational measurements, and Freeman has offered stimulating and helpful suggestions in his *Psychology of the Common Branches*, and his laboratory manual in *Experimental Education*. Contributions to the study of reading have been made by Thorndike and W. S. Gray, of writing by C. Truman Gray, of grammar and arithmetic by Starch, and of spelling by Otis. Perhaps the most interesting feature in experimental education has been the manifestation of tentative efforts in high school subjects. Here preliminary studies have been made by Monroe and Rugg in algebra, by Stockard and Bell in geometry, and by Hanus in Latin, and while none of these has yielded definitive results, trails have been blazed for further exploration.

For the coming year the JOURNAL OF EDUCATIONAL PSYCHOLOGY will publish a limited number of articles on general mental tests, measurements of intelligence, physiological studies, and aspects of the learning process, but in so far as possible the chief emphasis will be laid on experimental studies of behavior in school subjects. Articles are already on hand or in prospect on problems in reading, spelling, United States history, physics and chemistry, and readers of the

JOURNAL are invited to correspond with the managing editor if they know of studies of this sort which might be available. It will be the policy of the JOURNAL to give preference to articles that bear directly upon educational procedure, and to foster in every possible way the extension of experimental investigation to all phases of school work.

THE NEW YORK MEETINGS

The meetings of the American Psychological Association and Section L (Education) of the American Association for the Advancement of Science, at New York City, December 27–30, were full of interest for the scientific student of education. So numerous were the offerings of papers to the Psychological Association that parallel programs were arranged for several of the sessions, much to the vexation of those who desired to hear papers scheduled for different rooms at the same time. The division was made on the lines of pure and applied psychology, and in point of number and variety of papers presented, attendance at the meetings, and apparent eagerness to hear the subjects discussed the applied psychology sections seemed to be the most favored.

Papers of significance to educational psychologists were The Control of Accuracy of Movement, K. S. Lashley; Positive and Negative Perception and Recognition, Garry C. Myers; The Effect on Learning of the Length of Periods of Rest, Helen B. Hubbert; Experimental Studies in Memory, Edith F. Mulhall; Alleged Elements of Waste in Learning a Motor Problem by the Part Method, L. A. Pechstein; The Evaluation of a Method of Finely Graduated Estimates of Abilities, J. B. Miner; A Dissected-Story Test, Kate Gordon; A Graded Series of Dove-Tail Puzzles, Grace Helen Kent; Group Tests for Preliminary Mental Surveys of Institutions and Schools, Rudolf Pintner; The Mental Level of a Group of Immigrants, H. H. Goddard; Experiments in Vocational Selection, W. D. Scott; An Application of Standard Measurements of Achievement in School Work to a Group of Delinquent Women, Mary A. Clark; The Relative Value of $6\frac{1}{2}$ vs. $4 + 2\frac{1}{2}$ Minutes in Learning a Page of History, A. S. Edwards; Notes on the Use of Certain Binet and Related Tests on College Students, Elsie Murray; Mentality Testing of College Students, W. V. Bingham; University Instructors Tested by the Stanford Scale, June E. Downey; A Detailed Study of Whipple's Range of Information Test, J. C. Bell; Point-Scale Coefficients of Intelligence, R. M. Yerkes; The Weighting of Point-Scale Tests, Rose S. Hardwick; Diagnostic Value of Some Mental Tests, Carl C. Brigham; "Scattering" in the Binet-

Simon Tests, E. A. Doll; Some Differences between Normals and Defectives not Indicated by Intelligence Tests, Florence Mateer; Comparison of the Binet-Simon Scale (1911) with the Stanford Revision and the Yerkes-Bridges Point-Scale as Given to Delinquent Women, Mabel R. Fernald and Mary H. S. Hayes; A Study of Tests Additional to those of the Binet Scale as Given to Delinquent Women, Mary H. S. Hayes and Mabel R. Fernald; and The After-History of Fifty Delinquent Girls, H. H. Goddard.

Of especial promise was the report made by J. B. Watson on his opportunities and plans for studying the reflex and other native equipment of newly-born infants. We have had many sporadic observations of the behavior of the newly-born, but comparative, experimental studies have been lacking. Dr. Watson's laboratory chances to be situated adjacent to a lying-in hospital and he is able to gain access to thirty or forty newly-born infants a week. Many of these he will be able to follow through the whole of the first year or longer. He has already demonstrated that practically every infant exhibits the reflex clasp under the proper conditions, and that with many infants this is so strong as to sustain the whole weight of the body by a single hand. He is making careful, quantitative studies of this and other forms of behavior which will be of the greatest importance for our understanding of the human organism.

Another event of peculiar interest was the celebration of the twenty-fifth anniversary of the founding of the American Psychological Association. Papers were presented by G. Stanley Hall, who was the leading spirit in the organization of the Association; by J. McKeen Cattell, who characterized in brilliant and witty phrase the chief tendencies in psychological research during the past twenty-five years; by Joseph Jastrow, another member of the original group at Johns Hopkins, who, paraphrasing James, described some "Varieties of Psychological Experience" which he had observed in the last quarter century; and by John Dewey, another member of the same group, who voiced the need of carrying the methods of present experimental psychology over into social psychology, and breaking with the schematic theories of social instincts that have reigned supreme in this field since the days of Tarde. This series of papers was felt as a great inspiration by all who were present, and they are heartily commended to the attention of the readers of the JOURNAL when they appear in print.

The general subject for the meetings of Section L. was "The Scientific Study of Educational Problems," and the papers gave evidence

of the increasing activity in the experimental investigation of education all over the country. Each session had nine or ten papers scheduled, and as a result there was little or no time for discussion. Lack of space precludes individual mention of important papers. Those that appealed most strongly to the writer were Fred S. Breed's and M. R. Trabue's studies with composition scales and H. A. Brown's and V. A. C. Henmon's investigations of ability in Latin. Instead of announcing Professor Thorndike's paper on "The Reliability of Certain Educational Tests" Vice-president Leonard P. Ayres said, "It is a well-recognized fact that educational psychologists in America are divided into two great classes." After a pause, during which everyone wondered what the nature of the classification would be, he continued, "We shall now listen to the *whole* of the first class." The audience appreciated the tribute and responded with hearty and prolonged applause.

Professor Robert M. Yerkes, of Harvard University, was elected president of the Psychological Association for the ensuing year, and Professor Edward Franklin Buchner, of Johns Hopkins University, vice-president of Section L.

AN EXPERIMENTAL SCHOOL

Announcement has been made that with the financial support of the General Education Board an experimental school will be opened by Teachers College, Columbia University, in the fall of 1917. Professor Otis W. Caldwell, of the University of Chicago, will be the director of the school, and becomes a member of the faculty of Teachers College, of which the new school is a part. This organization ensures the coöperation in and the careful oversight of the workings of the school by the faculty of Teachers College, and thus provides a source of helpful and constructive criticism for all of the experiments undertaken. "In the curriculum, modern languages will be stressed and experiments will be made with a view to determining what methods of teaching English, French and German give the most substantial practical results. New methods of teaching literature, history and civics will be tried, and in this connection efforts will be made to ascertain whether the important ancient classics cannot be effectively used in translations. Latin and Greek as languages will not be taught in the school. Science, industry and the domestic arts will be prominent throughout the school, and increased attention will be given to music, drawing and art. The subject of mathematics will receive

special consideration in the hope of working out a rational course of study which connects the study of mathematics with its use, and which also makes adequate provision for those who have special ability or desire for this subject. The school will frankly discard that theory of education known as 'formal discipline' and will undertake to secure training through the careful and thorough study of subjects which are in themselves valuable. It is believed that a much more effective discipline can be thus secured." The tuition fees will be moderate, and many parents have already signified their desire to have their children enrolled next fall.

This enterprise is of the greatest significance and of the highest importance for education in America. From such a school, established under the most favorable auspices of financial support, of administrative control, and of broad-minded, liberal policy, we may expect scientifically substantiated answers to many of the vexed problems of method and of the study of school subjects, which at present rest solely on tradition and opinion. But most important of all it ought to furnish many object lessons to educators as to how an educational experiment should be set and controlled. Unfortunately to this day few supervising officers and almost no teachers understand what an educational experiment is. Many of those high in authority still metaphorically cross themselves whenever experiment is mentioned in connection with the schools. Under the enlightened direction which this school will have we assume that it will be a genuine experimental school, not merely a demonstration of some one's pet scheme; that it will select certain problems that are amenable to experimentation, clearly define each problem, and so arrange conditions as to provide the clearest and most definite controls and checks on the reliability of the results. In other words this school ought to be for educational practice what the Rockefeller Foundation for Medical Research is for medical practice.

With this beneficent and most desirable end in view one is astounded that so progressive and enlightened a newspaper as the New York Times should appear with a two-column editorial branding the undertaking in the most denunciatory terms as "radical and dangerous." After quoting the purposes and aims of the school somewhat more fully than we have given them above and referring to Dr. Flexner's pamphlet "The Modern School," the writer indulges in the following amazing diatribe: "This is bread and butter education and nothing else. In the General Board's program and in the course of study

there is not a trace of anything tending to the development of character. There is nothing that would lead us to suppose that the graduate of the 'modern school' would have in his mind any ideas, any general ideas, any ideas at all above or outside the realm of his daily tasks. . . . We make bold to say that young men and women trained in this manner would be as destitute of culture as a Hottentot. Imagination will be cramped and stunted, knowledge and enlightenment abridged and shorn of those intellectual pleasures and satisfactions which make them a rich possession. . . . Unblushing materialism finds its crowning triumph in the theory of the modern school. In the whole plan there is not a spiritual thought, not an idea that rises above the need of finding money for the pocket and food for the belly. There is nothing that would implant in the mind of ingenuous youth the thought that there was anything worth while outside the shop, the market, and the laboratory; that of the vast accumulations of human thought any part is worth preserving save that which directly relates to making a living." And so on for two columns.

What is one to think of this? How are we to account for such an outburst of fury in response to the simple invitation "Let us prove all things educational, and hold fast to that which is good?" What a monstrous example it is of the mental bias engendered by the blind following of tradition! What better proof could there be of the need for an experimental school to show people of presumed intelligence what an educational experiment signifies?

J. C. B.

NOTES AND NEWS

The following program has been arranged for the meeting of The National Association of Directors of Educational Research at Kansas City, March 1: "The Problem of Measuring Ability to Read Silently," S. A. Courtis, Detroit, and H. W. Anderson, Dubuque, Iowa; "Correlation between Ability to Think and Ability to Remember, with Special Reference to United States History," B. R. Buckingham, Madison, Wis.; "Organized Effort in Educational Research in City School Systems," J. P. O'Hern, Rochester; "Fundamental Problems of Educational Research from the Point of View of a State Bureau," Charles Fordyce, University of Nebraska, F. J. Kelly, University of Kansas, and H. A. Brown, Concord, N. H.

Under the auspices of the Economic Psychology Association a conference was held at the Columbia University psychological laboratory, January 26 and 27, on the topic "The Human Element in Business." Several applied psychologists and many employers of labor participated in the conference.

Dr. James R. Angell, of the University of Chicago, is giving a course of lectures on "The Makers of Modern Psychology" on the Spencer Foundation at Union College.—*Science.*

Dr. Maria Montessori has been spending the past few months in New York City conducting courses at the Montessori Normal College, which was opened at 144 West 74th Street, New York City, last fall. She has also delivered several public lectures in various cities of the East.

At Harvard University Raymond B. Fosdick is giving courses in police administration, including the keeping of records, identification systems, and the psychology of the interrogation of persons arrested.

Last fall a survey was made of the San Francisco public schools by the staff of the United States Bureau of Education, assisted by John W. Withers, of St. Louis, Charles McMurry, and Fletcher B. Dresslar, of Peabody College, Nashville, and J. Stanley Brown, of Joliet, Ill.

Owing to the interest manifested in the work of the University of Missouri Elementary School by superintendents and teachers who expect to attend the meetings of the Department of Superintendence at Kansas City, and who wish to observe the school in session, arrangements have been made to hold school on Saturday, February 24, and on Saturday, March 3, as well as on the regular school days of the intervening week. Visitors to the school will be cordially welcomed.

On account of many requests for his first "Study of Mental Fatigue in Relation to the Daily School Program," (1913), Dr. W. H. Heck, of the University of Virginia, has recently obtained a few more cloth-bound copies, and will send them on request to libraries and to professors of education.

Professor Alfred L. Hall-Quest, of the University of Virginia, author of "Supervised Study," delivered a series of lectures on supervised study before the Teachers' Association of Rochester, N. Y., early in November. As a result the principal and teachers of the Washington Junior High School of that city have begun an extensive experiment to determine the effectiveness of study supervision.

Professor E. A. Kirkpatrick, of the Fitchburg, Mass., State Normal School, is spending the year as exchange professor at the Bellingham State Normal College, Washington.

Professor Theodule-Armand Ribot, well known in this country for his books on various aspects of psychology, died in Paris on December 8, at the age of seventy-seven years.

On December 16 Professor Hugo Muensterberg, of Harvard University, died suddenly while giving a lecture to his class at Radcliffe College. Professor Muensterberg published several volumes of contributions to psycho-physics at the University of Freiburg, and in 1892, at the suggestion of William James, was invited to come to America as director of the psychological laboratory at Harvard University. A few years later he took a very positive stand against certain questionnaire studies in psychology and education, which were very popular at the time, and for many years he was thought by school men to be hostile to educational psychology. In 1909, however, he showed in his book "Psychology and the Teacher" his hearty sympathy with experimental studies in education as carried on by Meumann, Stern, Thorndike and others, and he evinced a keen interest

in the foundation of the JOURNAL OF EDUCATIONAL PSYCHOLOGY. In recent years the bulk of his writings dealt with the application of psychology to law, medicine, industry, and social affairs, and his last large work in German was entitled "The Elements of Psychotechnics."

Dr. Naomi Norsworthy, associate professor of educational psychology in Teachers College, Columbia University, died on December 25, 1916. Dr. Norsworthy was an acute, penetrating thinker, an inspiring and broad-minded teacher, and a genial and sympathetic personality.

Dr. Helen M. Hubbert, adjunct-professor of philosophy and education at Randolph-Macon Woman's College, has returned to her work after a year's leave of absence.

Dr. Joseph K. Hart, formerly professor of education in the University of Washington, has been appointed professor of education at Reed College, Portland, Oregon. Dr. Hart is giving an extension course on "The Principles of Vocational Education." Another extension course on "Psychology applied to Business" is being given at Reed College by Dr. Ernest H. Lindley, head of the department of philosophy and psychology at Indiana University.

Mr. Alfred E. Rejall, formerly instructor in psychology in the New York State Teachers College at Albany, has been appointed instructor in education at Boston University.

Louie Winfield Webb, Ph. D. (Chicago), has been appointed instructor in psychology and education, and Willis Lemon Uhl, M. A. (Northwestern), has been appointed instructor in education at Northwestern University.

Wilbur H. Norcross, graduate student in psychology at the Johns Hopkins University, has been appointed associate professor of philosophy, psychology and education in Dickinson College, to fill the vacancy left by the death of Professor W. L. Gooding.—*School and Society.*

Dr. Elizabeth Woods some time ago resigned her position as assisant professor of psychology at Vassar College to become director of Child Welfare in Pasadena, California.—*Jour. Phil., Psych., and Sci. Meth.*

PUBLICATIONS RECEIVED

FREDERIC D. BARBER, MERTON L. FULLER, JOHN L. PRICER, AND HOWARD W. ADAMS. *First Course in General Science.* New York: Henry Holt and Company, 1916. Pp. vii, 607.

There is an increasing appreciation of the need of greater emphasis on natural science in our educational procedure, but also a recognition that the present methods of teaching science in the high school fail to meet that need. From this recognition has grown the demand for a general introductory course in science, which shall awaken the interest of pupils, give them some inkling of what may be expected in further work in science, and prepare for later intensive study of the special sciences. Many think that the best line of attack is through the biological sciences. The present authors prefer the physical environment. They consider first the production and use of light, then heat, refrigeration, the weather, the seasons (climate and health), ventilation, food and nutrition, micro-organisms, soil, water supply, sewage disposal, machines, work, and energy. Throughout the book utility to man is the essential criterion of selection. There is an abundance of excellent illustrations, a liberal use of simple graphic representations, and a rich array of the results of scientific investigations. With a good teacher such a text should arouse a high degree of interest in young people, and should make them much more familiar with their environment than the average man is.

GEORGE ALBERT COE. *The Psychology of Religion.* Chicago: The University of Chicago Press, 1916. Pp. xvii, 365. $1.50.

The author is frank in giving at the outset the personal attitudes that were influential in shaping the treatment of the subject. "It is socially desirable that 'an ideal socius' (God) should exist." The religious enterprise is the most important undertaking in life. Every religious experience is a datum to be examined analytically, and not to be referred to any dogmatic authority. Deep religious conviction does not involve mysticism, nor does it invalidate the accuracy of one's psychological thinking. The origin of the God-idea is found in man's organic and social need to see in the world about him a manifestation of the same sort of activity that he feels within him. Religion in all its forms is essentially the consciousness of relationship with this "ideal socius." The book presents interesting studies of conversion, the traits of religious leaders, religion and the subconscious, mysticism, the future life, prayer, and the religious nature of man. Since the whole trend of civilization is to increase the scope and solidarity of social relationships the author finds that the power of religion is waxing rather than waning. This may be true psychologically without in any way invalidating the conclusion that the historical forms of religion have far less influence than they had a generation ago.

HARRIET M. JOHNSON. *The Visiting Teacher in New York City.* New York: Public School Association, 1916. Pp. xv, 84.

The sub-title of this report is "A statement of the function and an analysis of the work of the visiting teacher staff of the Public Education Association from 1912 to 1915 inclusive." The visiting teacher is the connecting link between the school and the home. If a pupil is reported as failing in a particular subject, or is habitually late, or troublesome in the conduct of the school, the case is reported to the visiting teacher for investigation and treatment. The monograph gives a clear and moving account of the work of the visiting teacher, with many illustrative cases. It contains more social psychology in relation to educational problems than is usually found in such reports, and raises many serious questions in regard to the functions of the school in its relation to the community.

HARRY D. KITSON. *How to Use Your Mind.* Philadelphia: J. B. Lippincott Company, 1916. Pp. 216.

This book is intended by the author as "a psychology of study, being a manual for the use of students and teachers in the administration of supervised study." It is designed for high school students, or even for the upper elementary grades when properly interpreted by the teacher. It contains advice on such topics as note-taking, formation of study-habits, memorizing, concentrating attention, reasoning, self-expression, getting off plateaus, finding a mental second-wind, and securing the best bodily conditions for effective study. The author's intentions are excellent, but the language is somewhat pedantic, the statements about physiology are sometimes misleading if not quite erroneous, and the discussion seems rather thinly spread over a large number of pages. A simpler and more compact style would have added much to the value of the book.

CALVIN L. LEWIS. *A Handbook of American Speech.* New York: Scott, Foresman and Company, 1916. Pp. 246.

This is another book designed for training in oral English, and stands out from others in its emphasis on voice production. The first fifty pages deal with the physiology of voice production, and present many illustrative plates and exercises for voice training. The treatment is synthetic, combining sounds into words, words into sentences, and sentences into arguments. There are seventy pages of carefully chosen selections for practice.

MARY E. MOXCEY. *Girlhood and Character.* New York: The Abingdon Press, 1916. Pp. 400. $1.50.

Another book on girls! Yes, but this one is different. In the first place it is evidently written by one who is familiar with the literature of biological and experimental psychology, and who does not hesitate to apply that knowledge to the concrete situations of the discussion.

In the second place, while the author evidently knows her psychology, she has not attempted to write a psychological treatise, but has taken the problems that arise in the development of the girl and has tried to interpret and explain them to the parent or friend who is interested in her behavior. Above all there is a wholesomeness and sanity, a tone of sweet reasonableness pervading the entire discussion, that makes it stand out in sharp contrast to most "books on girls." There are four parts, the first dealing with childhood and pre-adolescence, and the others with early, middle, and late adolescence. The book is worth the careful attention of those who are interested in girls.

GARRY C. MYERS. *Incidental Perception.* Reprinted from the Journal of Experimental Psychology, 1: No. 4, 1916, 339–350.

The accuracy of incidental perception of time, size, and weight was only slightly less than in purposive perception. Time was overestimated, while size and weight were underestimated.

WILLIAM HENRY PYLE. *A Manual for the Mental and Physical Examination of School Children.* The University of Missouri Bulletin, Vol. 17: No. 24, 1916. Pp. 32.

This bulletin is a simplification and condensation of the author's *Examination of School Children* designed for the use of teachers. The tests are logical memory, rote memory, substitution, free association, opposites, word building and completion. In logical memory new and simpler selections are used, the stimulus words in the rote memory tests are rearranged, new and more extended lists of opposites are given, and the completion tests are added. The latter are composed of simple selections, the sources of which are not indicated. Tables and graphs of norms are presented, but there is nothing to show how these norms were secured, or upon what range and type of investigations they are based.

FRANCES ELLIS SABIN. *The Relation of Latin to Practical Life.* Madison, Wisconsin: Published by the Author, 1916. Pp. 124.

Whatever may be thought about the desirability of encouraging high school pupils to study Latin, all will agree that if Latin is taught it ought to be taught as effectively as possible. This little volume will be of great assistance to teachers in vivifying the study of Latin, in connecting it with the things that pupils think are worth while, and in making them appreciate the extent to which modern languages, modern literature and modern science have borrowed from the Latin. In a series of chapters constructed with the idea of putting the salient features on large cards for class display the author illustrates the value of Latin in enriching the meaning of English words, in grouping English words about Latin roots, in helping to spell, in understanding abbreviations, in appreciating references to classical literature, in studying Romance languages, in mastering scientific terms, and in

grasping the full significance of many terms commonly used in law, medicine, engineering, architecture, and business. The wide-awake teacher can extend the list indefinitely, and can thereby arouse a lively interest in her subject.

F. UMBERTO SAFFIOTTI. *La Misura dell' Intelligenza nei Fanciulli.* Rome: Societa Romana di Antropologia, 1916. Pp. viii, 286. Lire 6.

This elaborate and painstaking work on "The Measurement of Intelligence in Children" comes from the laboratory of the Institute of Anthropology and Experimental Psychology at the University of Rome, which is under the direction of Giuseppi Sergi. It will be remembered that Treves and Saffiotti were among the first to try the Binet-Simon tests and in 1910–12 published several reports on them and proposed various improvements. In this work the author gives a comprehensive survey of the history and present status of mental testing, discusses in detail the applications of the Binet tests, and in the last hundred pages develops the method of Treves-Saffiotti and illustrates its use by comparing the results obtained by it with those from the Binet tests. There is a bibliography of 603 numbers. The book is an important contribution to the subject of mental testing, and deserves careful study at the hands of all workers in the subject. Unfortunately the author does not include in his discussion any reference to the Yerkes Point Scale or Terman's recent work (they are mentioned in the bibliography), and the fact that he has depended largely upon Meumann rather than upon original sources for his knowledge of American studies has led him into some curious errors.

CARL E. SEASHORE. *Vocational Guidance in Music.* University of Iowa Monographs, First Series, No. 2, 1916. Pp. 11.

This bulletin announces the establishment of the Psychology of Music Studio, a branch of the psychological laboratory of the University of Iowa, for the scientific study of musical aptitudes according to the plans outlined in the author's *Psychology in Daily Life.* The bulletin indicates the nature of the tests, gives a number of musical talent charts, states the conditions under which a professional musical examination will be made, and outlines a plan for music surveys in the public schools.

ROBERT L. SHORT AND WILLIAM H. ELSON. *Introduction to Mathematics.* New York: D. C. Heath and Company, 1916. Pp. vii, 200.

"This book employs the increasingly popular correlated method, combining related portions of arithmetic, algebra, and geometry. It treats these branches of mathematics more with reference to their unities and less as isolated entities (sciences)." The book is built upon the equation, and both arithmetical and geometrical problems

are to be solved by equations. There is an abundance of problems, which the considerate teacher will doubtless use sparingly and with discretion.

BORIS SIDIS. *The Causation and Treatment of Psychopathic Diseases.* Boston: Richard G. Badger, 1916. Pp. 418. $2.50.

"Psychopathic diseases are not hereditary, they are acquired characteristics." Such is the challenge with which this book opens. It is true that such acquisitions are possible only on the assumption of an exceptionally sensitive nervous system, but the author contends that the disturbance itself is no more inherited than the susceptible patient inherits smallpox or diphtheria. In the book we find a discussion of psychopathic reflexes, the fear instinct, the laws of recession and reversion, the impulse of self-preservation, and the psychopathic substratum. The author lays great weight on the method of hypnoidization in the treatment of psychopathic disturbances and savagely attacks the eugenists for willful perpetuation of error in ascribing mental instability to heredity. "The value of the hypnoidal state for the treatment of psychopathic affections is in the lowering of the high thresholds, and in the formation of associations with utilization of accumulated stored-up energy requisite for the restoration of the higher psychic functions, for the exercise of the voluntary and personal control over the dissociated, automatically or subconsciously functioning groups of systems."

HENRIETTA BROWN SMITH, Editor. *Education by Life. A Discussion of the Problem of the School Education of Younger Children.* Baltimore: Warwick and York, 1916. Pp. viii, 211. $1.25.

This book is a collection of articles by eminent English teachers on such topics as the personality of the teacher, religious training, health, literature, handwork, music, games, nature study, number, reading, writing, history and geography. The primary teacher will find many valuable hints and suggestions in the book.

DANIEL STARCH. *Educational Measurements.* New York: The Macmillan Company, 1916. Pp. vii, 202. $1.25.

As the first attempt to bring together the widely scattered work on educational scales and measurements this book will attract the attention of educational investigators, superintendents and teachers. A brief introductory chapter on the significance of educational measurements is followed by a consideration of the reliability of school marks, particularly marks in English, mathematics and history. Here the author draws chiefly upon his own published studies and shows the wide distribution of teachers' marks on the same test paper. A survey of the marking system in a single high school shows great inequality in the marking standards of different teachers. A five-step marking scale and a closer approximation of the marks to the normal distribution are recommended. In succeeding chap-

ters the following scales and tests are presented; the Starch, Thorndike, and Kelly reading tests; the Thorndike and Ayres writing scales; the Starch, Ayres, and Buckingham spelling lists; the Starch grammar scales; the Starch and Courtis arithmetic tests; the Hillegas-Thorndike and Harvard-Newton composition scales; the Thorndike drawing scale and the Rugg lettering scale; and a series of tests suggested by the author in Latin, German, French, and physics. To the student of educational measurements the book is distinctly disappointing, in that an inordinate amount of space is given to the presentation of the tests themselves (frequently in unnecessarily large type), while there is almost a complete absence of discussion of the derivation of the tests, there is scarcely any mention of the results of their application, and there is no critical or constructive comment of any sort. It is a mere collection of test materials, rather than a scientific contribution to educational measurements.

HANNIS TAYLOR. *Cicero: A Sketch of his Life and Works.* Chicago: A. C. McClurg and Company, 1916. Pp. xiv, 615. $3.50.

This splendid work is not merely a biography of Cicero, the man, but it is rather a scholarly, broad-minded, philosophical portrayal of the closing years of the Roman republic, "a commentary on the Roman constitution and Roman public life." The author is eminently fitted for the task he has chosen. His studies on the English and the American constitutions and on international law have given him a background of comparative government which it would be hard to equal, and have furnished him with an incomparable equipment for the interpretation of Roman life to modern thinkers. But it is not for its ripe scholarship and its broad scope alone that the book is to be commended. The lucidity and simplicity of the narrative, the dramatic power with which the persons and events are presented, the vividness and distinctness with which the political intrigues of the time are painted make the narrative as enthralling as a romance. Every teacher of Latin or of Roman history, and every one who is interested in that momentous governmental revolution from the Roman republic to the empire should have this book at hand for reference.

LEWIS M. TERMAN. *The Measurement of Intelligence.* Boston: Houghton Mifflin Company, 1916. Pp. xviii, 362. $1.50.

The sub-title of this book is "an explanation of and a complete guide for the use of the Stanford revision and extension of the Binet-Simon Intelligence Scale." For some time the initiated have known of the work on tests of intelligence that was going on at Stanford University. Many have spoken of it as the most extensive and most carefully conducted investigation of intelligence tests that has ever been undertaken. Here we have the first publication regarding it. It is true that we shall not find in this book the statistical presenta-

tion of the results of that investigation. The scientific report, which is eagerly awaited by advanced students of mental testing, is reserved for a subsequent volume. The present book is a popular and untechnical discussion of the general principles of mental testing, and furnishes a guide for the practical conduct of the tests by teachers, physicians, and social workers. It is also intended as a text in normal schools, colleges, and teachers' reading circles. It will be seen that the author does not share the disinclination expressed by many psycho-clinicians to countenance the use of measuring scales by those untrained in technical psychology. "While the use of the intelligence scale for research purposes and for accurate diagnosis will of necessity always be restricted to those who have had extensive training in experimental psychology, the author believes that the time has come when its wider use for more general purposes should be encouraged." The book is in two parts. Part I discusses the uses of intelligence tests, the sources of error in judging intelligence, the Binet method, the nature of the Stanford revision, the significance of intelligence quotients, and the reliability of the Binet method. Part II is a detailed guide for the administration of the scale with specific directions for giving and scoring each question.

GUY MONTROSE WHIPPLE. *How to Study Effectively.* Bloomington, Illinois: Public School Publishing Company, 1916. Pp. 44. Fifty cents.

This little book is the result of the request of a group of high school pupils for advice on the technique of studying. "A survey of the available literature seemed to warrant the conclusion that, despite the existence of a number of books upon the art of study, there was still room for another treatment that should be limited to the direct laying down of a series of rules or maxims, with just sufficient explanatory comment to make them readily intelligible and serviceable for the needs of the average high-school or college student." The book will commend itself to both teachers and pupils by its brevity and conciseness of statement. The rules are just thirty-eight in number, each printed in heavy black-faced type with a half-page to a page of comment. Some of the rules are: "Form a place-study habit." "Form a time-study habit." "Do your work with the intent to learn and to remember." "Get rid of the idea that you are working for the teacher." "Don't apply for help until you have to." "Before beginning the advance work, review rapidly the previous lesson." "Give most time and attention to the weak points in your knowledge or technique." "You must daily pass judgment as to the degree of importance of items that are brought before you, and lay special stress on the permanent fixing of those items that are vital and fundamental." "When drill or repetition is necessary, distribute over more than one period the time given to a specified learning." "In committing to memory a poem, declamation or oration, do not break it up into parts but learn it as a whole."